Politecnico di Torino

Gender perspective of professional competencies in industrial engineering programs at Politecnico di Torino

Thesis of Master of Science

By

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Abstract

Gender perspectives about different professional competencies and stereotypical roles assigned to genders, sexism in higher education, and possible effects are relatively under-explored. They are of great interest in more increased education regulations. Gender equality in Europe is ahead and is on par with internationally followed guidelines; Italy's performance is below compared to the European average. The women's participation in science, technology, engineering, and mathematics (STEM) is less and is considered a significant problem for the gender gap. This research aims to understand professional competencies and their influence on the selection of majors at universities considering several factors such as gender, typical roles associate with genders. Based on the comparison between the international and national situation of gender equality in Italy, this research analyses gender perspectives in the industrial engineering field of the Politecnico di Torino, intending to explore the gender phenomenon in universities, the reasons behind them, and possible effective measures. The results show that female students will not choose a major based on the course's difficulty but will make a comprehensive choice based on their interests, interference from external factors, and self-ability perception. After analyzing students' professional abilities, we tried to determine measures that might help Politecnico di Torino improve the imbalance and conduct research.

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature: Jinxian Yuan

Date: __26 March 2021____

Acknowledgements

When my thesis was about to finish, I looked at the paper and felt it's hard to believe that. Two and a half years have passed unconsciously, and it is hard to imagine that my graduate career will come to an end. In this experience, the professors who helped me grow up and my family who have always encouraged me are those who have the most profound impact on me. Special thanks to my supervisor, Professor Laura, for her selfless help in writing my thesis. Your carefulness and guidance have benefited me a lot.

Besides, I have to give a special thanks to my parents and boyfriend. Whenever I encounter difficulties, my parents always encourage me, thank them for their support in the distant motherland day and night, and thank them for their material and spiritual support always. And my boyfriend Mazhar Sher Khan, thank you for your love and always give me a warm hug when I cry.

Finally, I am very grateful to the PoliTo. I cannot become a better and stronger person without the training of my alma mater. I will always be thankful for the two and a half years I have spent in Italy.

Gender perspective of professional competencies in industrial engineering programs at Politecnico di Torino

1 Introduction

1.1 background

1.1.1 The current situation of gender in Europe and Italy

Gender Perspective has many definitions and meaning varies based on the context. According to the council of Europe, a gender perspective is defined as "the characteristics that differentiate socially constructed roles and behavior masculine or feminine and which are attributed to individuals based on their sex at birth." [1] The purpose of this cultural analysis is to explore the hierarchy, power inequalities between men and women.

In recent years, research on the impact of gender discrimination and gender relations on university education has been a worldwide concern. Many studies have shown that even in universities, the proportion of women in high-level positions in many institutions is still incredibly insufficient. As an example, some recent research is commented on below. In 2016, women were underrepresented, especially in the highest positions in Italian academia; it has been found that when there are a small number of places, the chance of promotion for women is much lower, especially for full-time professors. [2]

Besides, in 2020, the European university association research shows that it is only less than 10 percent of female rectors in Italy [3].

The European Union (EU) Gender Equality Strategy seeks significant Progress towards a gender-equal Europe by 2025[4]. Achieving gender equality and empowering women and girls is an unfinished business of our time and the most significant human rights challenge in the world today, claim Antonio Guterres, the Secretary-General of the United Nations [5]. Nevertheless, there is still a long way to achieve absolute equality between women and men and eliminate all gender prejudice. Therefore, eliminate all internal and external violence against women, create a more harmonious, comfortable, equal, and tolerant space for survival and development for women, and provide all-female with a broad area for advancement and equal enjoyment of career, medical care, health, and further aspects, is an important topic and the direction which needed the whole world contribution. According to data from the World Economic Forum (WEF) in 2006, gender equality is receding. Progress on particularly critical economic pillars has slowed severely. The current gender gap is still 59%, the highest record since 2008. The European Commission announced the "Gender Equality Strategy 2020-2025" in March 2020. It issued a related statement before the "March 8th" International Women's Day, striving to bridge the gender gap in employment, salary, care, pensions, Etc., and promote economic development [5]. The strategy proposes critical actions to achieve gender equality in the next five years and promises to incorporate the concept of equality into all EU decision-making and significant initiatives. In recent years, the EU's Progress in promoting gender equality has been slowed down, and there are noticeable differences among countries. According to the European Institute for Gender Equality, the EU's gender equality index in 2019 was 67.4 (percentage scale), which was only 5.4 points higher than in 2005. Among the indicators, inequality of rights is the most serious [5]. One of the significant challenges the EU needs to address is the inequality in employment and career development for men and women. According to statistics, the EU women's salary is 16% lower than men's, and the gender pension gap is 30%. Improving gender equality in the labour market can raise EU countries' per capita GDP by 10% [5].

1.1.2 Professional Competencies and Gender

Professional competencies are skills, knowledge, and attributes that are valued explicitly by professional organizations such as professors, Engineering companies, and entities that are connected to future careers.[6] "Professional information" can be understood as "a set of knowledge, technology, skills and study method.

The attitude required for a specific job" is the characteristic that the applicant must have. Professional competencies can be divided into three different levels according to the type of ability.[7]

Basic competencies: these are derived and developed at schools, such as reading, writing, comprehension, comprehension, and communication. These competencies range from application to performance.

Generic competencies: These are a set of knowledge, skills, and attributes that allow you to solve a specific task in a given context when used in an integrated method.

Technical Competencies: Technical competence describes the application of knowledge and skills required to effectively perform a specific job or set of jobs within an organization. These abilities are closely related to the knowledge and skills or "know-how" required for successful performance.[8]

The relationship between competencies and employment factors is also apparent. Generic competencies entail factors such as sex, age, race, belonging to an ethnic group, socioeconomic condition, heath, Etc. Employment factors are usually known as career development opportunities, fair pay structure, flexibility, Etc. Job performance competencies are linked to fundamental skills, employment, motivation, job search, relational skills, personal assessment, conciliation with the workload, and network. Professional academic ability includes standardized training, supplementary and certificates, professional experience, general and technical skills, available time, displacement availability, and updates in the market.

According to the study of Maria in 2020, the professional roles and gender bias exist in the daily routine task, and for example, household work is usually associated with a female as some might argue that it comes naturally to the woman and for make is to do more physically demanding work and taking care of female.[9] Social labor gender stereotypes and rules related to these stereotypes, whether implicit or external, will produce biased rules and affect the professional abilities expected by men and women. It is worth noting that this stereotype does not begin to be experienced after students enter society but is likely to have been invisible in the growing environment, including the educational environment.

Table 1.1.2 social labor stereotypes and gender

Professional Roles Biased by Rules and Stereotypes	**Male or Female**	**Explicit OR Implicit rules according to Social-Labor stereotypes**	**Social-Labor stereotypes Gender Discrimination**
Teaching	F	Professional feminization	Predisposition to care
Housekeeper	F	Precarious work	Household chores dexterity
Textile Industry, Cashier	F	Control, Not money management	Routine manual skills
Flight attendant	F	Physical attraction of clients	Sensitivity to physical image
Construction, Logistics	M	Away from physical work	Less physical force
Research, Technology	M	Less presence in scientific & tech sectors	More emotional than rational
Armed Forces and Security	M	Exclusion of dangerous work	More prone to irrigation or sacrifice
Transport	M	Exclusion of high mobility jobs	Less willingness to move
Housework	F	Lower public projections	Interested in working at home
Home Assistance	F	Reduced working hours	Lower wages are accepted

University competence is affected by gender. To identify and eliminate all university teaching prejudices, a detailed analysis of the themes, processes, and different aspects of learning should be carried out. Competence is the combination of knowledge, skills, values, and attitudes that enable individuals to deal with specific problems and propose solutions in academic or social contexts. These perspectives outline gender concepts and values; these social/cultural values vary according to the university's financial situation, history, and geographic location and are related to male or female factors.

1.2 Gender profile in Italy Education

According to 2017 published by the World Economic Forum (WEF), The Global Gender Gap Report, in Italy, the Gender Gap Index (GGI), an index measures the relative gaps between men and woman in the area of health, education, economy and politics ranked Italy at 82 positions out 144 countries measured on this index, it shows showing that its gender equality issue is still not taken forcefully and needs to be strengthened. Meanwhile, Italy's situation is incredibly complicated because although courses, seminars, doctorate, and master's courses on women and gender studies exist in various institutions, achieving gender equality in education and employment opportunities will still take a long time.

According to the national labour organization, the female labour force participation rate in Italy from 2010 to 2017 was lower than the OECD average (69% in 2017) and only higher than Mexico, which is the last in a whole organization [10]. Besides, the female unemployment rate of Italy ranks third, second only to Greece and Spain. Not only that, according to the Global Economic Forum in 2020, Italy's gender index, an index that measures the complex concept of equality and assists in monitoring, ranks seventy-sixth. In this ranking, Iceland is the first position, Spain is the eighth, and France is the fifteenth [11]. The report further pointed out that in the economic participation rate and opportunity ranking, Italy ranks 117th, education level ranks 55th, and health care ranks 118th. Compared with other European countries on gender differences, there is still a particular gap between Italy and those countries, reflected in the economy, health care, education, and other aspects. There may be several reasons for the gap between gender equality in Italy and other countries. However, university reform envisages inserting gender perspectives into different courses of varying degrees. The lack of recognition by higher-level institutions has caused setbacks, and there is a lack of communication between the various departments that are conducting women and gender studies. Less communication between Italian universities and even the same temple slows down content and progress. The Italian Constitution stipulates (Article 3), "All citizens are equal, without differences in gender, religion, and social status."[12] The declaration is considered sufficient to ensure that women have no barriers to entry into teaching positions at any level of the education system, nor will they prevent women from engaging in various jobs and occupations. There are anti-discrimination laws and regulations to guarantee equal treatment and opportunities between men and women in addition to constitutional principles. However, they involve the labour market and do not specifically mention education. At the national level, specific policies on gender in education have not yet been issued, and so far, the adoption of these policies has not been considered. However, at the local level, gender equality projects and initiatives aimed at schools and teachers have been recognized here and there by research organizations, associations, and regional, provincial or municipal governments. According to the data of the Italian Institute of Statistics, the gender ratio of university graduates and teachers and practitioners from 2010-2014 are shown in Table 1.2.1.

Table 1.2.1 2010-2014 the gender ratio of university graduates and teachers in Italy

Year	**Graduates**		**Teachers**		
			Professors		**Other academic teachers**
	Total (male and females)	**female (per 100 graduates)**	**Full professors**	**Associate professors**	
2010	289130	58.7	15854	16990	24939
2011	298872	58.9	15242	16632	24596
2012	297448	59.3	14522	16159	24264
2013	302231	59.3	13890	15810	23746
2014	304608	59.2	13263	17541	21035

It can be seen from Table 1.2.1 that during the period 2010-2014, the proportion of female graduates in Italy showed an increasing trend, and there was a very slight decline from 2013 to 2014. However, it is worth mentioning that the number of teachers, also reported in Table 1.2.1, is generally declining. This phenomenon is particularly evident among full-time professors and other academic teachers. The number of assistant professors experienced a sharp decline in 2013 and then reached an inevitable increase in 2014. Furthermore, the data of students involved at universities rate by gender in 2009-2010 is shown in Table 1.2.2

Table 1.2.2 New entrants at university, students within and beyond the legal duration of the course and enrolment rate by sex

Academic year	New entrant	students				Enrolment rate		
		Within the legal duration of the course		Beyond the legal duration of the course		male	female	Male and female
		As % of total students	Female as % of total students	As % of total students	Female as % of total students			
2009/2010	294720	65.7	57.6	34.3	56.4	33.2	46.2	39.6
2010/2011	288286	66.4	57.5	33.6	56.2	32.8	45.5	39.0
2011/2012	278666	66.8	57.5	33.2	56.2	33.0	45.6	39.2
2012/2013	253825	-	-	-	-	33.1	45.7	39.3
2013/2014	252457	-	-	-	-	32.2	44.1	38.0

**Data referring to the academic years 2012/13 and 2013/14 aren't available due to the change in statistical source (Register of Students).*

By analysing the enrolment rate in Italian colleges and universities from year 2009 to 2014, it is evident that the enrolment rate is decreasing. The gender ratio of females is significantly higher than that of males. Nevertheless, the latter has not changed much and maintained a stable trend, while females' proportion has shown a weak declining trend over five years. Through further analysis of high school and university education, we distinguished and sorted the data by geographical distribution and gender in 2012/2013. The latest data published by the Italy Institute of Statistics [13] are reported in Table 1.2.3

Table 1.2.3 Upper secondary and tertiary education graduates by sex, region and geographical area in 2012/2013 academic year

Geographical	Upper secondary education	Universities education

location	Graduate s	Females (as % of total graduates)	As % of population aged 19	Graduates	Females (as % of total graduates)	As % of population aged 25
Centre	85900	50.8	80.8	50990	58.4	44.2
South	134454	49.1	83.7	44452	62.2	25.6
Islands	54850	51.2	74.3	20718	63.7	25.7
North-West	98925	51.9	71.2	51658	57.8	35.0
North-East	76046	51.9	74.6	41896	61.2	39.0
North average	87485.5	51.9	72.9	46.777	59.5	37.0

In Table 1.2.3, it is shown that in upper-secondary education, and the average north-region has the highest female percentage rate (51.9%) among all of the areas, a difference of 2.8 from the southern region with the lowest female graduation rate (49.1%). However, in university education, females' percentage rate in all graduates in the north part is only 59.5%, only higher than the center part, but lower than both south and island regions. Breaking down the northern region, we found no difference in the proportion of female high school graduates between the west and the east. However, the proportion of female college graduates in the north-east (61.2%) is significantly higher than that in the north-west (57.8%), with a difference of 3.4%. Among them, the female graduation rate of college students in the north-west is the lowest in all regions, at 57.8%, and the highest in the island region is 5.9%.

Figure 1.2.1 the map of Italy north-west

Therefore, we focus on analysing the north-western region of Italy. The regions that belong to the northwest are Aosta Valley, Liguria, Lombardy, and Piedmont, see Figure 1.2.1and Table 1.2.4.

Table 1.2.4 Gender distribution of college students in north-western Italy in Academic year 2010/2011

	Students	Female	The percentage of female in all students	Number of public universities
Aosta valley	1422	1032	0.73	0
Liguria	36303	20540	0.57	1
Lombardy	250651	136244	0.54	7
Piedmont	99582	52569	0.53	3

As can be seen from the above table 1.2.4, in the north-western region of Italy, the proportion of female college students in Piedmont and Lombardy is relatively low. Among the data, the proportion of women in Piedmont is 0.53, ranking the last one in the list. It is quite different from the highest Aosta area, which has the highest female percent rate 0.73. There are three public higher education institutions in Piedmont: The University of Turin (Università degli Studi di Torino), the Politecnico di Torino (Politecnico di Torino), and the Piemonte Orientale "Amedeo Avogadro "University (Università degli Studi del Piemonte Orientale "Amedeo Avogadro") [14]. As the most famous university in Piedmont, the Politecnico di Torino, and a university focusing on engineering and technology, has become our primary observation target.

1.3 AIM OF THE THESIS

Since we have analyzed Italy's education situation and showed noticeable regional differences and gender imbalances, to understand the reasons behind and conduct further research, we chose Politecnico di Torino (we will use PoliTo all below) as our research sample. We will use a gender perspective to explore and research in the field of target university industrial engineering. Based on the overall situation, our research will focus on the differences between genders (grades, interests, personal choices, etc.) and the distribution inequality in various disciplines from undergraduate to graduate students. Later, we would conduct a more in-depth study based on these data to discuss its reasons and further analyze the practical measures that may be effective for universities and educational institutions to change this status quo.

2 Gender Studies at the Politecnico di Torino

2.1 The environment of university and corresponding settings

According to the 2013 ISCED-F Classification of Education and Training Fields [15], the degree programs offered by PoliTo fall into three main research fields: (i) Humanities and Arts, (ii) Natural Sciences, Mathematics, and Statistics, and (iii) Engineering, Manufacturing and construction. The enrolment of the PoliTo is concentrated in engineering, manufacturing, and construction. In the 2019/2020 academic year, there are 19,452 bachelor's degrees with an enrolment registration rate of 93.42% and 13,664 master's degrees with an enrolment registration rate of 98.5%. Liberal arts and art students are a minority group in PoliTo. Only 929 bachelor students and 201 master students registered this year, accounting for 4.46% and 1.5% of all master programs in the whole university. Not only that, but in the three-year undergraduate courses in the fields of natural sciences, mathematics, and statistics, 441 students (2.12% of the total number) are admitted. [9] It can be seen that among the various fields of PoliTo, engineering and architecture are the leading research fields.

To prevent and combat all forms of discrimination based on gender, race, religion, personal and political beliefs, and to provide and further promote equality for every individual in work and education, CUG (Comitato Unico di Garanzia) was also established in July 2014 at PoliTo. The PAP (Positive Action Plan) of the CUG of PoliTo For the three years 2019-2021 is the second PAP by the CUG and is prepared in implementation of the provisions of Legislative Decree n. 198/2006 "Code of equal opportunities between men and women" (Annex 1) and subsequent Code of Conduct of the PoliTo (Annex 2) and Code of Ethics (Annex 3)[16], according to which the Administrations have the task of removing any discrimination based on gender, which has the consequence or purpose of compromising or preventing the recognition, enjoyment or exercise of rights in the workplace. The Directive of the Ministers for Public Administration and Innovation and for Equal Opportunities of 4 March 2011 concerning the Guidelines on the functioning of the "Single Guarantee Committees for equal opportunities, the enhancement of the well-being of those who work and against discrimination, "Identifies among the propositional tasks of these Committees" the preparation of plans of positive actions, to promote substantial equality in the workplace between men and women." [17]

As a polytechnic institution, PoliTo can be divided into four teaching areas departments: 1) Industrial engineering, 2) Information technologies, 3) Industrial engineering and management, Mathematics for engineering, and 4) Civil environmental ENG., Architecture, and Industrial design. Further subdivided, the industrial economy department includes DENERG (Energy), DIMEAS (Mechanical and Aerospace Engineering), and DISAT (Applied Science and Technology). Information technologies including DAUIN (Control and Computer Engineering) and DET (Electronics and Telecommunications), Industrial engineering, and management, including DIGEP (Management and Production Engineering) and DISMA (Mathematical Sciences). Furthermore, the last department Civil Environmental ENG, Architecture and Industrial design, divided by DAD (Architecture and Design), DIATI (Environment, Land and Infrastructure Engineering), DISEG (Structural, Geotechnical and Building Engineering), and DIST (Regional and Urban Studies and Planning).

As of December 1, 2019, PoliTo Politecnico di Torino has 983 Faculty members, including 247 full-time professors, 399 assistant professors, and 337 researchers, among which 30% of all teaching staff are women. Simultaneously, there is 899 administrative staff. Females accounted for 61% [18]. In terms of enrolled students in the Academic year 2017/2018, there are 35,000 undergraduate and master students in all, and women account for only 28% [19].

2.2 Gender analysis of PoliTo

According to the newest gender report in PoliTo, in AY 2019/2020, including all of the bachelor and master students, there are 34687 students enrolled in PoliTo, Women accounted for 28.95% [20]. Breaking down the data further, the number of students in the three-year degree program is 20,822, of which 5927 are female students (28.46% of the three-year degree) and 14,895 male students (71.53% of the three-year degree). On the other hand, in terms of master's degree programs, there are 4,115 women (29.7% of the population with a master's degree) and 9,750 men (70.3% of the population with a master's degree), a total of 13,865[20]. The Engineering area accounts for 86.2% of the total student population while the Architecture area for 13.8%. The main data are collected in Table 2.2.

Table 2.2 The total enrolled students in PoliTo in AY 2019/2020 by gender

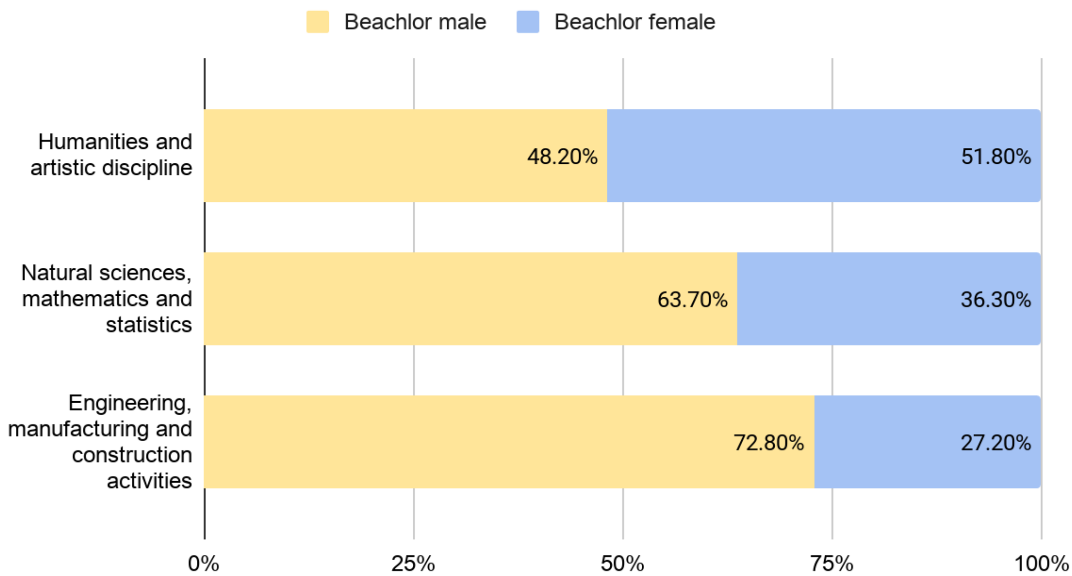
	Total number	**% of Male**	**% of Female**
Bachelor's and Master's	34,687	71.05	28.95
1st and 2nd level master’s and	300	72.67	27.33

Executive Master			
Doctor	763	66.84	33.16

In order to further analyse the proportion of students at PoliTo, we use the gender report published by PoliTo in 2020 in the following charts [20]. The purpose of this chapter is to study the performance of students of different genders in schools to explore in-depth academic inequality. The research can be further refined to observe the proportion of male and female students in various majors, student performance, graduation time and salary level after graduation and many other aspects.

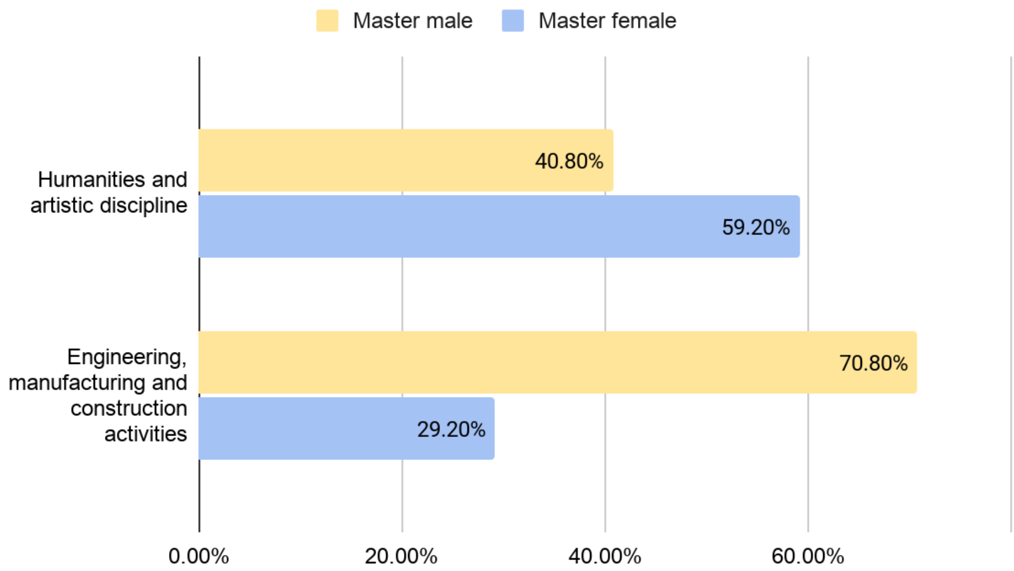
2.2.1 Observation of the proportion of different genders

Figure 2.2.1 The enrolled bachelor students in AY 2019/2020 by subjects and gender



According to Figure 2.2.1, after dividing the disciplines of PoliTo into three categories, it can be clearly concluded that apart from the humanities and art disciplines, the PoliTo has obvious gender segregation. The engineering manufacturing and construction activities fields are the most obvious area. The proportion of newly enrolled male is as high as 72.8%, and females is only 27.2%. In the natural sciences, mathematics and statistics area, there is also an uneven gender distribution in the statistics category, with males accounting for 63.7%, while females are only 36.3%.

Figure 2.2.2 The enrolled master students in AY 2019/2020 by subject and gender



According to Figure 2.2.2, we further analysed the gender ratio of master students. It is worth noting that, in the area of Humanities and artistic discipline, male does not have a quantitative advantage, female students are 59.2%, that is higher than the half. Nevertheless, in the Engineering manufacturing and construction activities area, the situation has not improved. Men still account for the vast majority of majors, even up to 70.8%, and female students only account for 29.2%. However, comparing the data showed in figure 2.2.1 and figure 2.2.2, the proportion of women with master's degrees are slightly higher than that of bachelor students, both in humanities and artistic discipline and Engineering, manufacturing and construction activities. For in-depth research, we will observe the subject as two different fields as engineering and architecture, since these two fields have distinct phenomena. Men dominate the field of engineering, as the enrolment rate is higher compared to women, while in architecture, this gender difference is less obvious. To verify this statement, we refer to the undergraduate and graduate data released by PoliTo in the academic year 2018/2019, see figure 2.2.3.

Figure 2.2.3 The percentage rate of enrolled students in engineering and architecture divided by gender in bachelor program (BA) and master program (MA) in AY 2018/2019

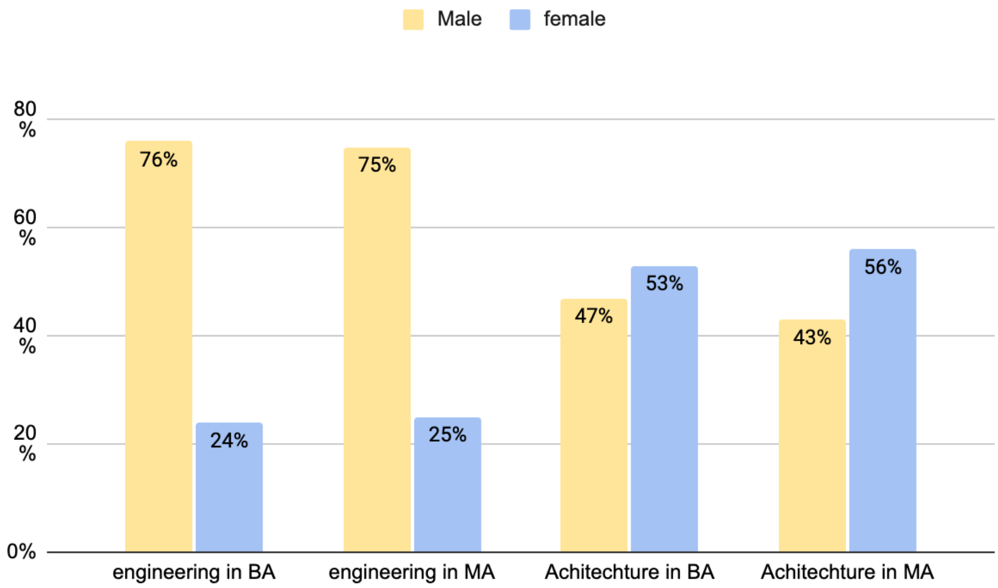
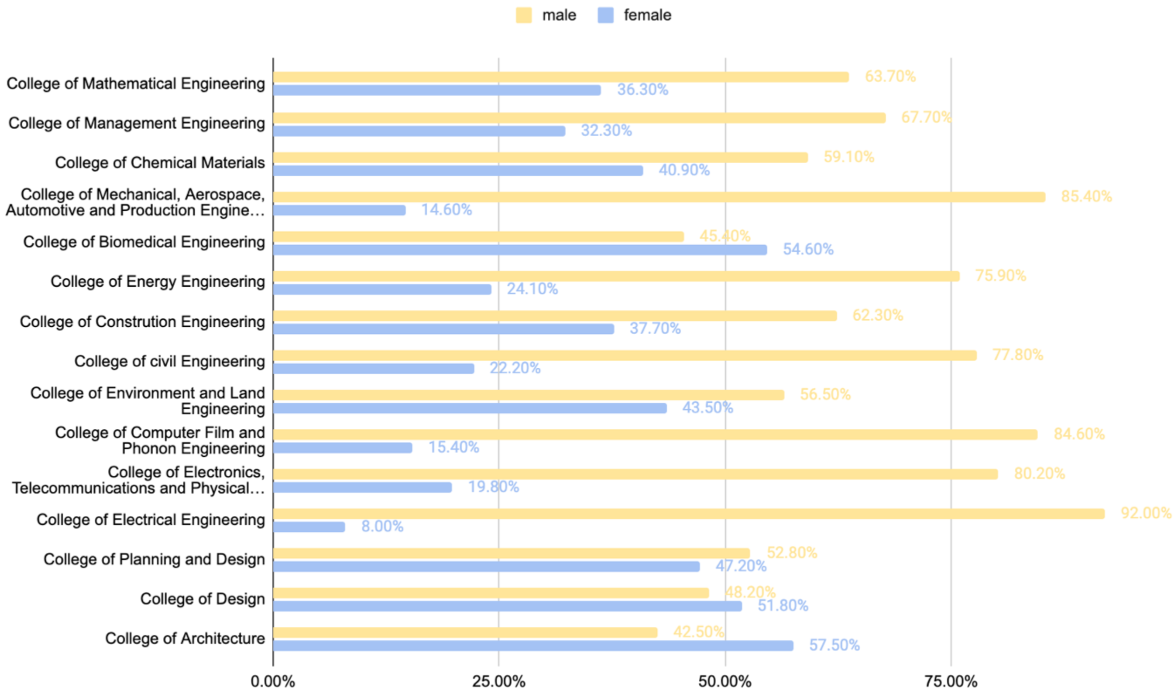


figure 2.2.3 reveals that the gender distribution of master and undergraduate programs has almost the same enrolment trend in the fields of engineering and architecture. In engineering, the male percentage rates of both bachelor program and master program are much higher than female rates, the former are nearly three times the latter. As for the Architecture area, data is quite different. Whether undergraduate or graduate, the proportion of women is higher than that of men, the proportion of women studying for a master program is even higher, and the difference with the proportion of men is 13%. Therefore, we conclude that at the PoliTo, female students in the field of architecture have a good participation rate in both bachelor and master programs, and there is almost no gender segregation. In the engineering field, there are very significant gender differences.

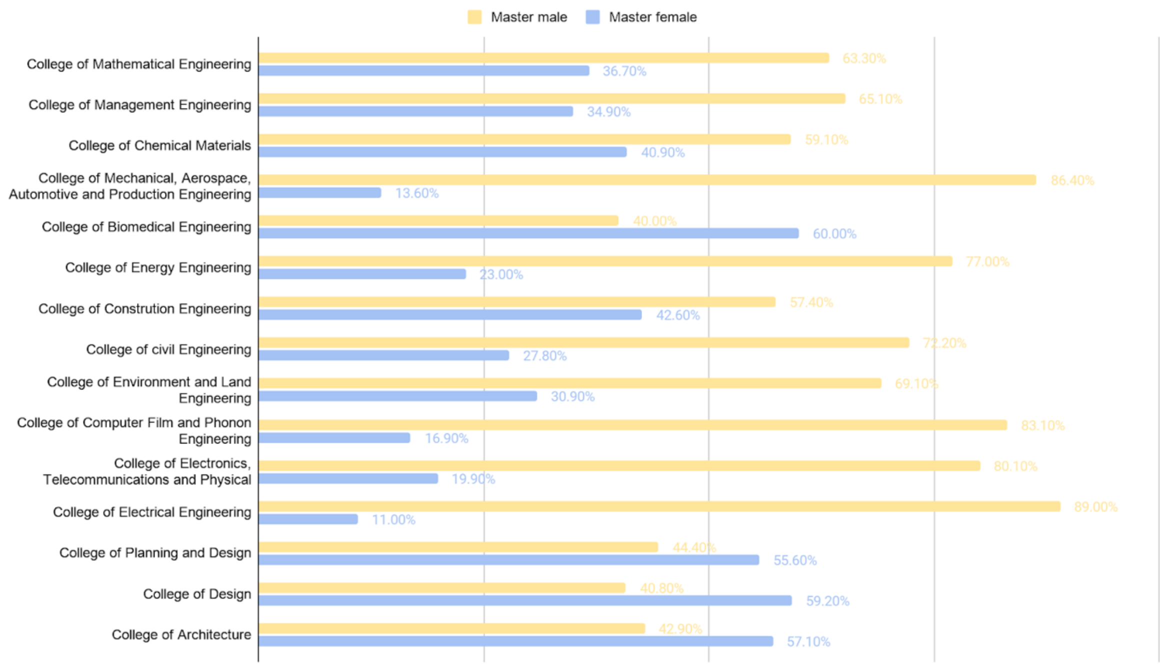
Figure 2.2.4 The enrolled bachelor students in AY 2019/2020 by college and gender



It can be seen from the data in Figure 2.2.4 and 2.2.5 that, excluding a few subjects, most students at the PoliTo have an imbalance in the sex ratio. There are only three colleges where the proportion of women is higher than the average: College of Biomedical Engineering, Design, and Architecture.

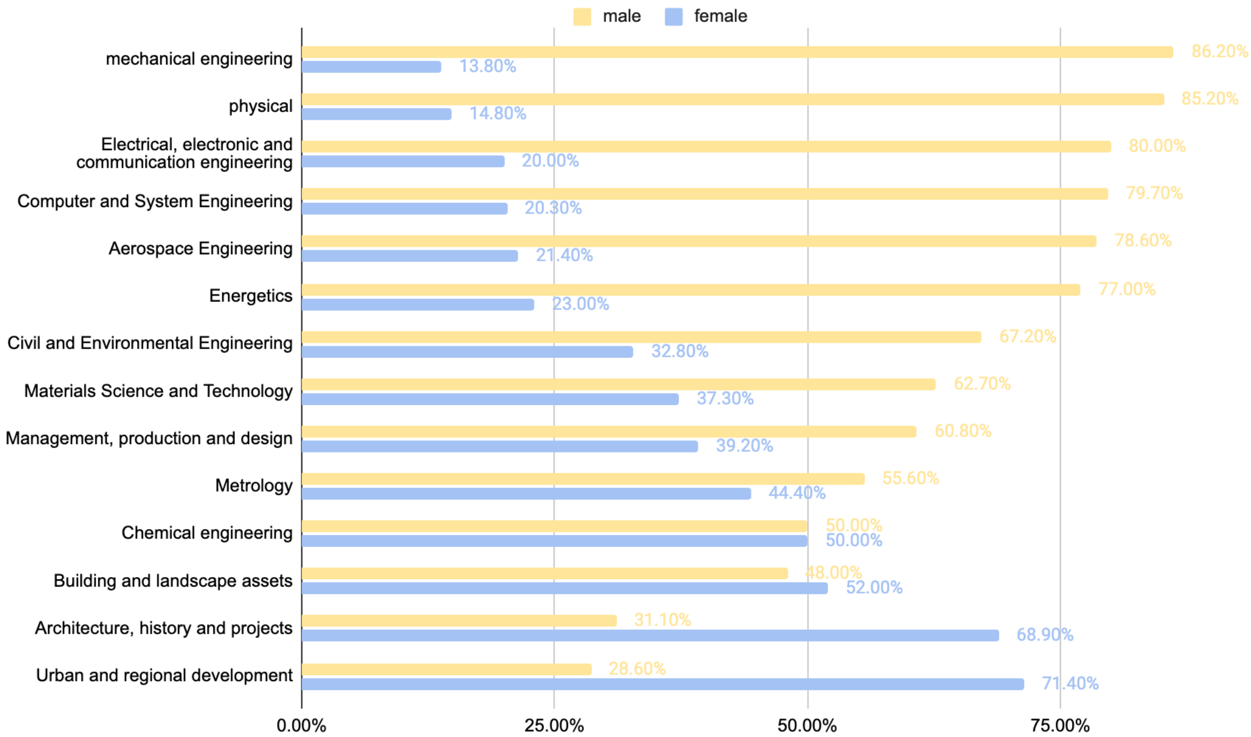
The Biomedical engineering program has the highest proportion of female students in the school, reaching 57.5%. Among the three colleges, only the status of the college of Biomedical does not belong to our classification of architectural disciplines but belongs to the field of engineering. Continuing to analyse the above chart, it can conclude that there is a severe gender imbalance in almost all engineering disciplines. Electrical engineering has the highest imbalance between men and women, with men as high as 92% and women accounting for only 8%. Followed by mechanical, aerospace engineering, and computer film engineering, men's proportion is 86.4% and 84.6%, respectively. There are also different degrees of gender imbalance in other engineering fields. The School of Chemical Materials and the School of Environment and Land are correspondingly less imbalance. The proportion of women is 40.9% and 43.5%, but there is still a phenomenon that the proportion of men is higher than that of women. The existence of horizontal segregation has been verified in these data. It usually refers to women's difficulty in entering traditionally-concept male-dominated jobs, such as professional workers and drivers represented by manual labour, and jobs that have a higher social status and focus on professionalism. Such as doctors, lawyers, and research scholars [21]. Part of the undergraduate students of PoliTo has a second phenomenon: professional-level segregation. Due to social factors, different genders are concentrated in specific positions, and it is difficult to obtain other jobs. There are many studies supporting this theory, such as（Sanders and Beeks in 1993), women are more likely to engage in jobs that fit these roles (for example, less required physical work) [22]. Therefore, the PoliTo has much room to play in promoting gender equality in the real-world scenario and breaking the segregation phenomenon. In order to determine the rationality of this conclusion, we analyse the situation of master students.

Figure 2.2.5 The enrolled master students in AY 2019/2020 by college and gender



Consistent with expectations, master's students' situation is similar to that of undergraduates, and the colleges with the most unbalanced proportions are still the Colleges of electrical engineering and aerospace engineering. The proportion of women in electrical engineering has increased by two percentage points than undergraduates, but it is still very unbalanced. Regardless of whether they are undergraduates or masters, that College has the worst gender ratio in the whole university.

Figure 2.2.6 The enrolled PHD students in AY 2019/2020 by course and gender



The enrolment rate of Ph.D. students of different genders also proves the existence of gender imbalance. The subjects with the most significant difference in men's ratio to women are mechanical engineering, physics, and electrical engineering. The difference in the ratio for the two genders in metrology and building and landscape assets two courses is not significant. Even chemical engineering has achieved a balanced ratio of men and women.

The analysis of the gender situation of undergraduate, master and doctoral students reveals similar gender imbalances in these three different teaching programs. It could be concluded that the entire PoliTo has shown the phenomenon of gender segregation in the physiognomy project. In fact, this phenomenon is very common. According to statistics, since the eighteenth century, the participation rate of women in science technology, engineering and mathematics (STEM) subjects has historically been low.[23] For polytechnic institutions such as the PoliTo, this imbalance proportion will become more obvious.

Figure 2.2.7 The Bachelor enrolment rate in engineering in 2010-2020 by gender

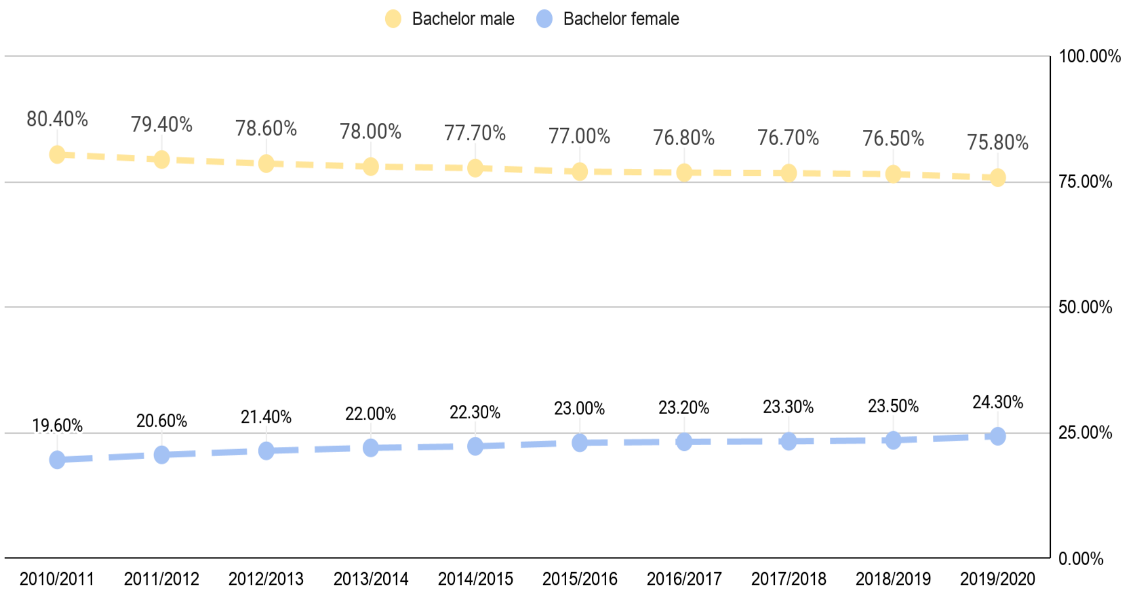
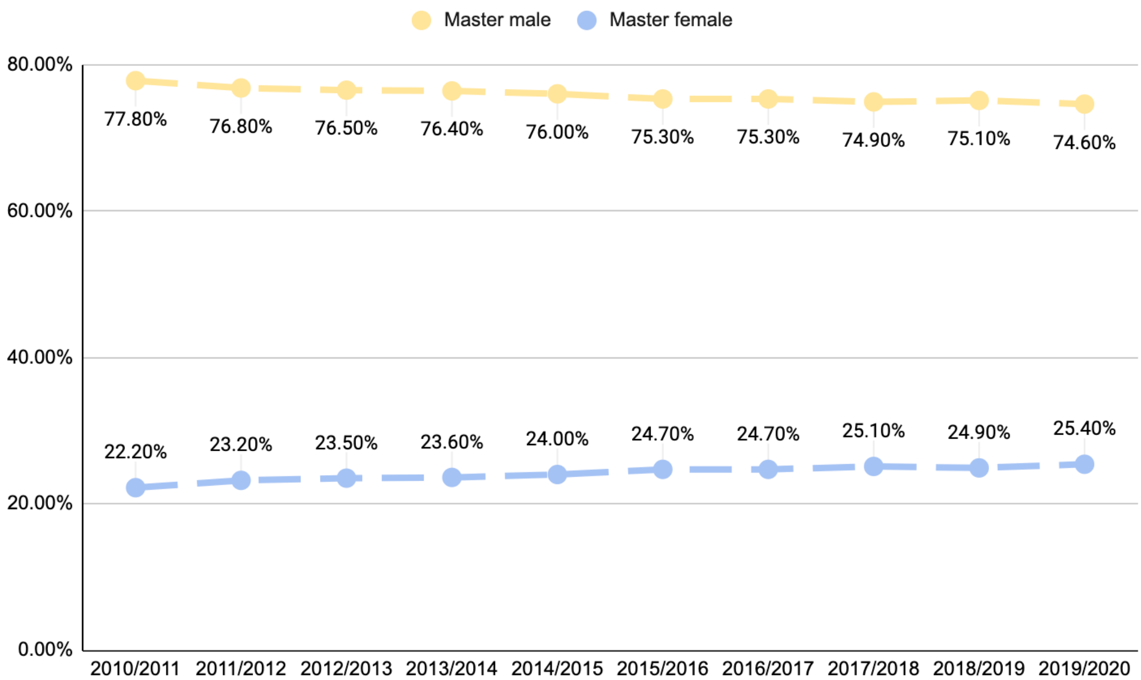


Figure 2.2.8 The master enrolment rate in engineering in 2010-2020 by gender



The figure 2.2.7 and 2.2.8 show that from the academic year 2010/2011 to 2019/2020, the female enrolment rate for both undergraduate and master's degrees in engineering has increased. In the past decade, undergraduates' female enrolment rate has marginally increased by 4.7%, and for masters by 3.2%. The phenomenon shows that gender segregation has been weakly alleviated at this stage.

Figure 2.2.9 The bachelor enrolment rate in architecture in 2010-2020 by gender

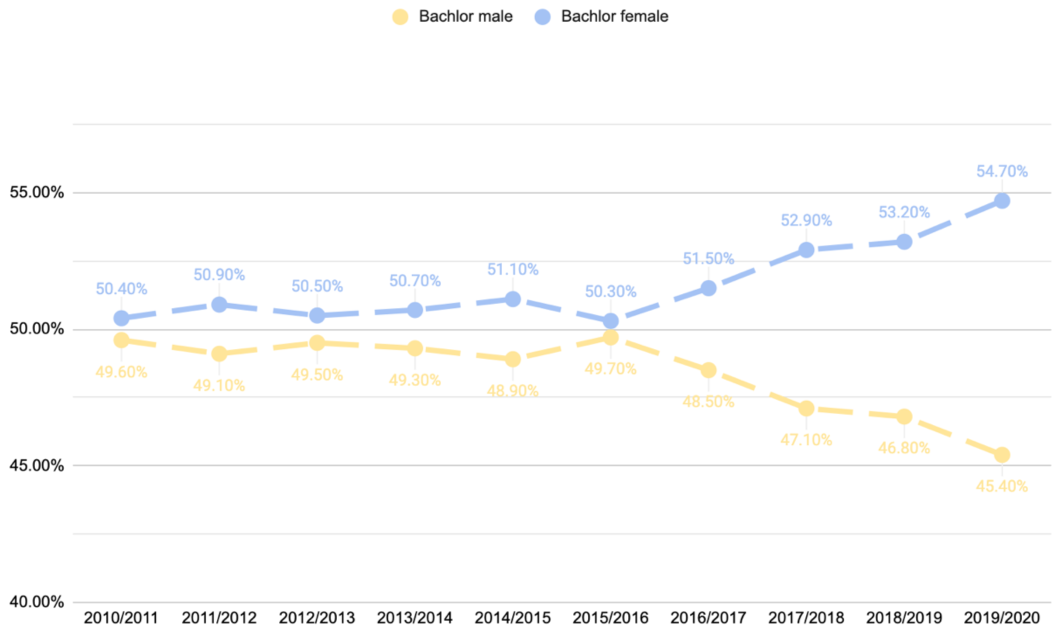
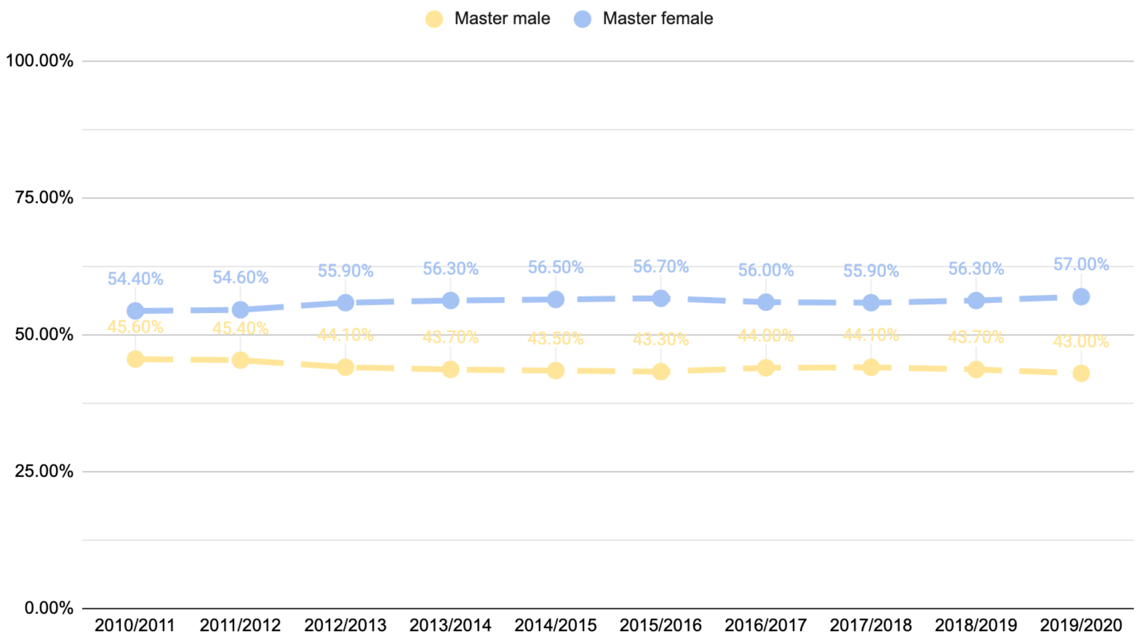
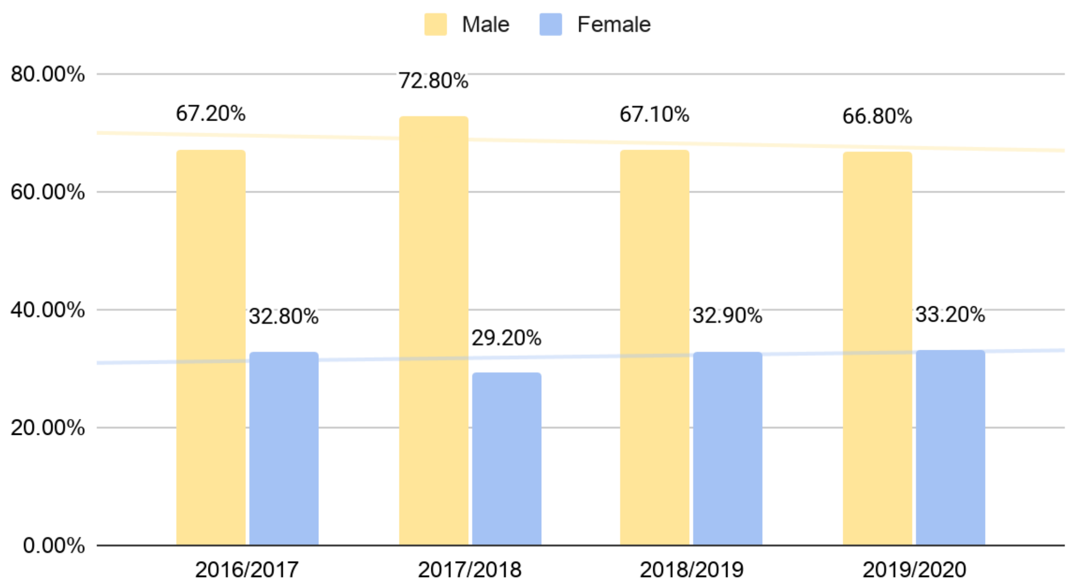


Figure 2.2.10 The master enrolment rate in architecture in 2010-2020 by gender



When the target is set to students in architecture, a difference can be found. Regardless of whether the observation object is a bachelor or master, women's participation rate is higher than that of men. Moreover, overall, the female enrolment rate has risen during this decade, while males' rate is the opposite. Even starting from the 2015/2016 academic year, the undergraduate male enrolment rate in architecture has been declining year by year compared to before. Corresponding to this is the rapid increase in the female enrolment rate, and it is from this year, the enrolment rate of different genders has begun to widen the gap, unlike most majors at the PoliTo, males in architecture do not have an absolute advantage in proportion, and females studying for master's degree in architecture even have a significantly higher proportion than men.

Figure 2.2.11 the enrolment rate of PHD students in 2016-2020 by gender



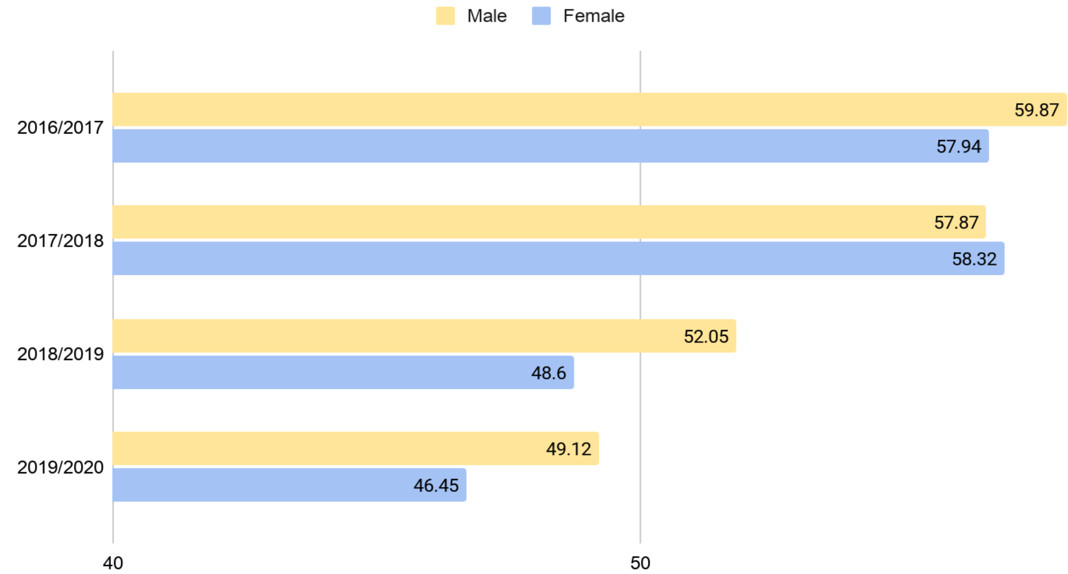
Extending the research object to Ph. D, it could be found that gender segregation will always exist from 2016 to 2020, just like undergraduate and master's programs. Therefore, we can see that gender imbalance is a widespread phenomenon in PoliTo, as evidenced by the different research levels from undergraduate to doctoral degrees and target research subjects of additional years.

2.2.2 Observation of the grade performance of different genders

Another important indicator is the student's performance in university. Therefore, we start by analysing the PoliTo 's admission test scores for the past four years from the PoliTo gender report 2020.

Figure 2.2.2.1 2016-2020 Architecture entrance examination average score by gender

Figure 2.2.2.2 2016-2020 Engineering entrance examination average score by gender



Through the study of Figures 2.2.2.1and 2.2.2.2, in the engineering field, excluding the 2016/2017 school year, the average scores of male students in 2017-2020 are higher than female scores. In the 2019/2020 academic year, the difference is the largest at 2.99. The architecture field also shows similar characteristics. In the 2017/2018 academic year, the average score for males was slightly lower than that for females, with a difference of only 0.45. However, in all other observation years, males' average score was higher and produced higher differences. The gender report of the PoliTo in 2020 also pointed out this accordingly. In general, men in the field of architecture and engineering performed relatively well in the entrance examination.[20]

Figure 2.2.2.3 2019/2020 bachelor female students score distribution

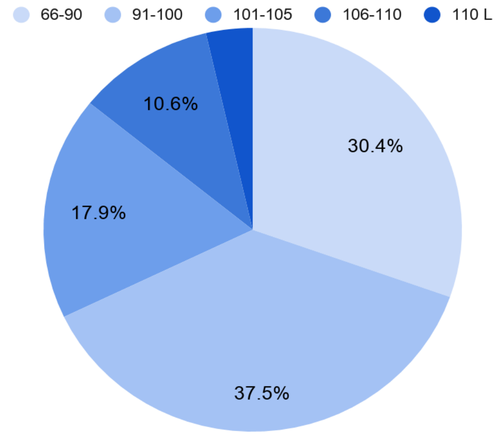


Figure 2.2.2.4 2019/2020 bachelor male students score distribution

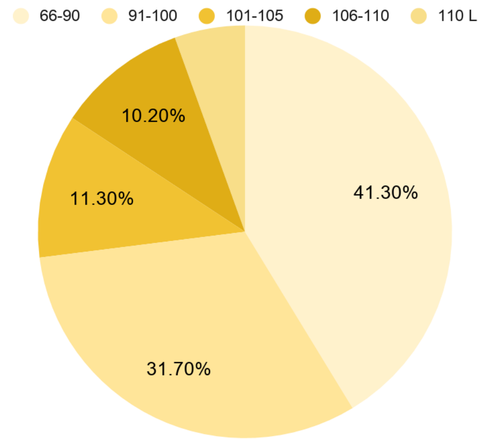


Figure 2.2.2.5 2019/2020 master female students score distribution

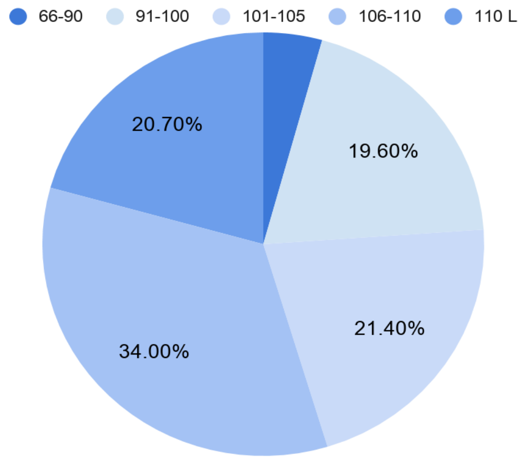
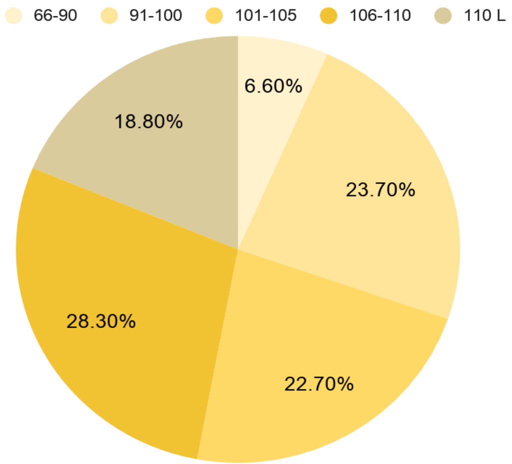


Figure 2.2.2.6 2019/2020 master male students score distribution



The following conclusions are drawn through statistics of the score distribution of different genders for undergraduates and masters: for undergraduates, the largest proportion of female students is scored 91-100, reaching 37.5%. The score segment with the most male distribution is scored 66-90, accounting for 41.3%. By dividing the scores greater than or equal to 106 into the high piece, it can be seen that the proportion of females reaching the high segment is 15.7%, while the balance of males is 14.2, there is only a little difference between boys and girls in this item. When taking the master students' results as the research object, the situation is as follows: different genders have the most distribution in the 106-110 score range, 34.0% for women and 28.3% for men. In the low segment scored 66-90, female students still have less distribution than male students, only 4.3%, while the proportion of males is 6.6%. This fraction is the smallest distribution of both genders.

Moving then to the analysis of the average graduation time in the engineering and construction fields, the collected data are reported in Table 2.2 and 2.3 for architecture and engineering programs.

Table 2.2.2.1 Average graduated time in engineering and delay rate

Years	**Bachelor**			**Master**		
	Male	Female	Average	Male	Female	Average
	5.10	4.50	4.80	3.60	3.20	3.40
Delay rate	1.70	1.50	1.60	1.80	1.60	1.70

Table 2.2.2.2 Average graduated time in architecture and delay rate

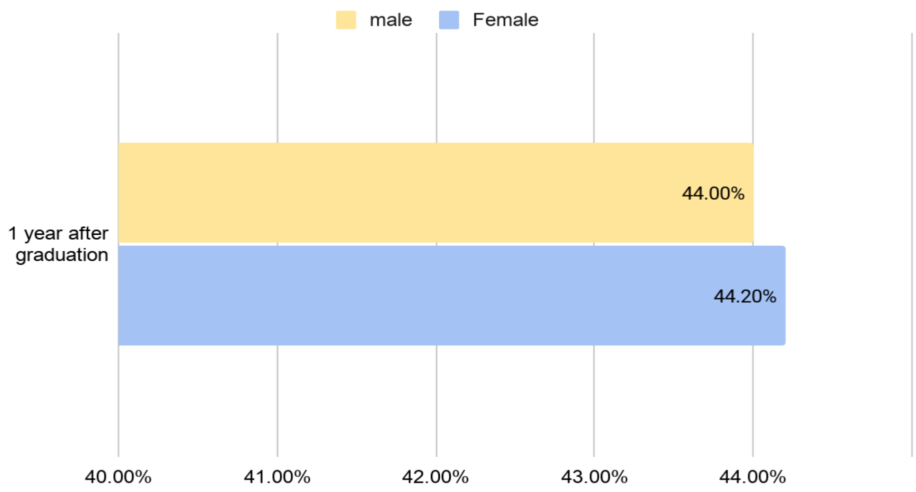
Years	Bachelor			Master		
	Male	Female	Average	Male	Female	Average
	4.90	5.00	4.95	3.70	3.50	3.60
Delay rate	1.63	1.67	1.65	1.85	1.75	1.80

In these two subject areas, the same phenomenon of delayed graduation appears, which may be related to the difficulty of PoliTo courses. From a gender perspective, first of all, taking the engineering field as the observation object, it can be concluded that the average time for men to graduate is longer both in bachelor and master programs. For undergraduate programs, men spend 0.6 years longer than women, while master programs' gap decreases to 0.4 years. In architecture, the situation has undergone a subtle change. The phenomenon of delay in graduation between the two genders still exists. Although the gap is tiny, only 0.1 years, men obtain bachelor's degrees narrowly faster than women; on the other hand, women still have an advantage in the length of master's degree graduation. Research on the field of architecture again supports the previous view: in PoliTo, the discipline of architecture is the closest to gender equality.

2.2.3 Work performance after graduation of different genders

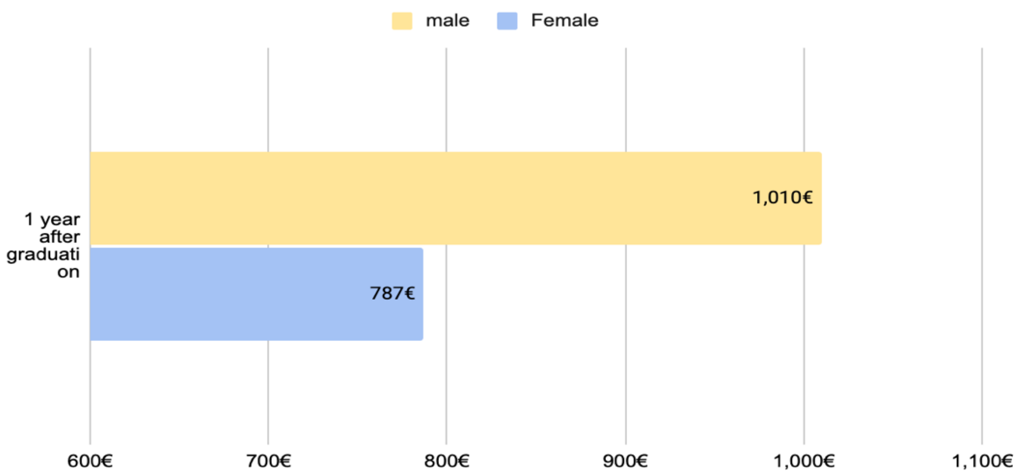
According to the Gender Equality Report issued by PoliTo in October 2020, we have obtained the gender-specific graduation rate for undergraduates and masters. The report divides the observation objects into two categories, namely graduates of different genders who graduated one year and five years after graduation.[20] The results are reported in Figures 2.2.3.1 and 2.2.3.2.

Figure2.2.3.1 The bachelor employment rate 1 year after graduation by gender



The employment rate of undergraduates one year after graduation is greater than 40% for two genders. The employment rate difference between the sexes is not massive, and the female employment rate is 44.2%, which is slightly higher than the male employment rate of 44.0%.

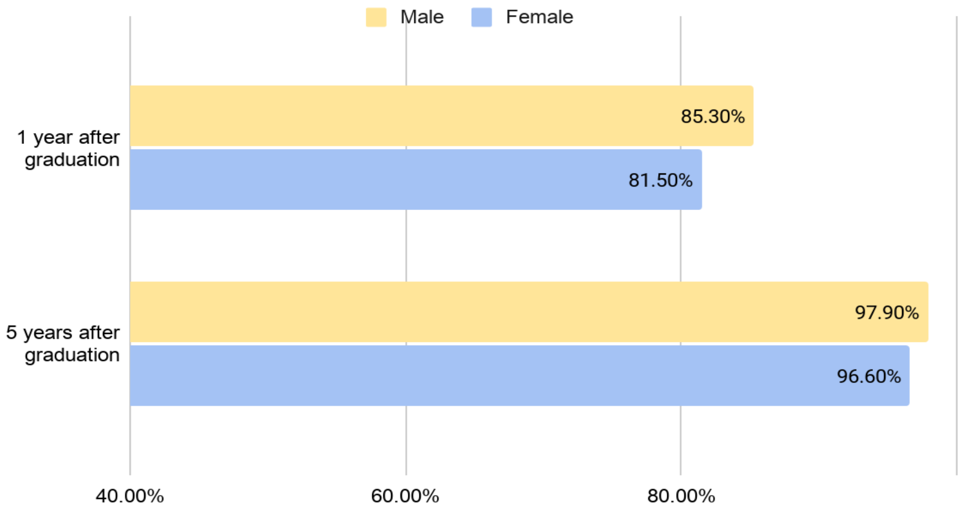
Figure 2.2.3.2 The master employment rate in 1 year and 5 years after graduation by gender



Further study the phenomenon of the employment rate of masters, we can see that the gap is widening. Whether it is one year or five years after graduation, men's employment rate is higher than that of women. Among those who graduate one year, men's employment rate is 85.3%, which is 3.8% higher than women. Five years after graduation, the male employment rate was 97.9%, 1.3% higher than that of females. Therefore, it can be concluded that as time goes by, the difference in employment rates between men and women gradually decreases. This phenomenon, more or less, reflects that companies may be more inclined to men when recruiting. However, with the accumulation of work experience and personal skills, this bias might decrease.

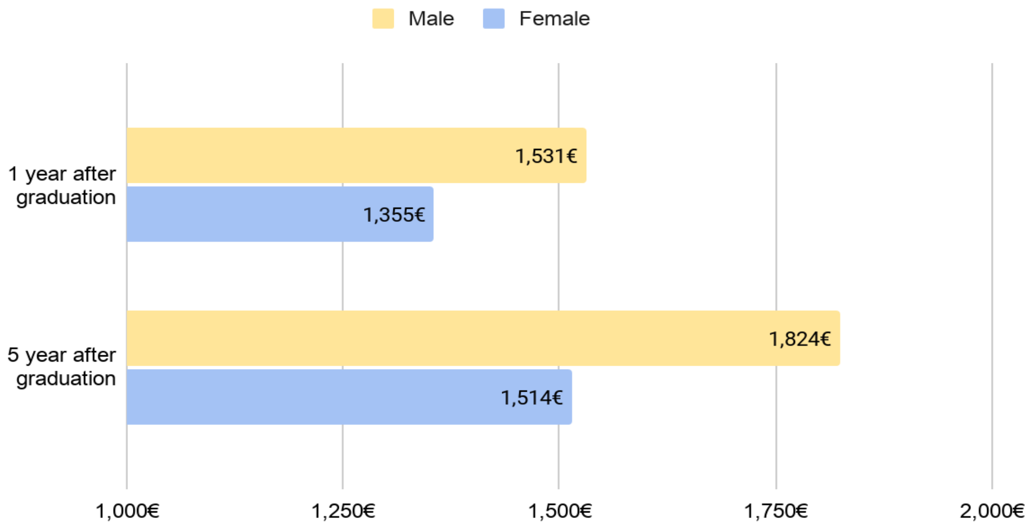
Besides, the salary level of graduates is also a worthwhile sample to study.

Figure 2.2.3.3 Average salary of bachelor students in 1 year after graduation by gender



Among the undergraduates who graduated for only one year, there is a very serious imbalance in the salary levels of men and women. The average salary of men is 1010 euros, compared with the average salary of women only reached 787 euros.

Figure 2.2.3.4 Average salary of master students in 1 year and f years after graduation by gender



For those who have obtained a master's degree, one year after graduation, men are usually paid an average salary of 1531 euros, while women are paid an average wage of 1355 euros. The average salary difference between men and women is 176 Euros, and this value is less than the average salary difference between men and women of 223 euros after graduation one year. However, the salary gap has widened again over time. Five years after graduation, the average salary for male graduates of a master's degree is 1824 Euros. For women, it is only 1514 Euros, and the difference reached 310 Euro, the highest level of the three subjects. This proves that the graduate data of the PoliTo shows also sex vertical-segregation after the horizontal segregation.

Compared with the horizontal segregation problem that depends on student interests, social environment, and university admissions policies, vertical segregation is mostly influenced by companies and employers' attitudes. The company and industry environment are closely related to employees' development, directly affecting employees' salary levels. For undergraduate and master's degree graduates, women's salaries are lower than men. This gap has widened over time, which shows that women are being mistreated and are in a dire dilemma for promotion.

Figure 2.2.3.5 The distribution of male job fields one year after graduation

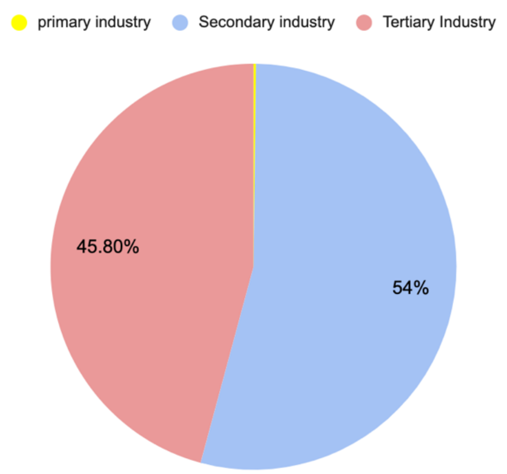


Figure 2.2.3.6 The distribution of female job fields one year after graduation

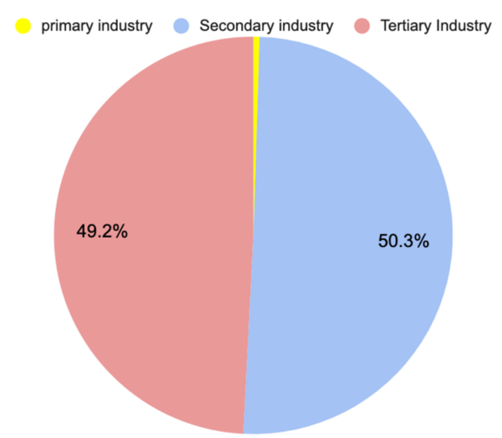


Figure 2.2.3.7 The distribution of male job fields five years after graduation

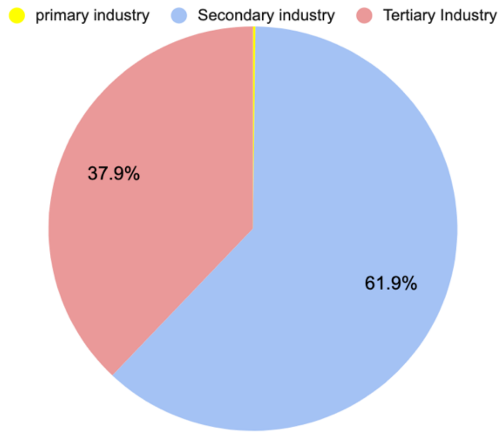
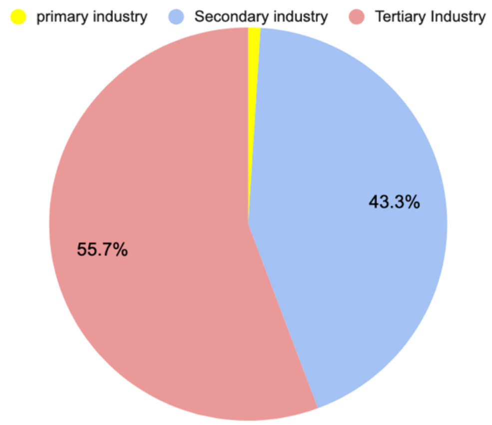


Figure 2.2.3.8 The distribution of female job fields five years after graduation



Continuing to analyse graduates' employment fields by gender after one to five years of graduation, it could be found that the field of male employment is concentrated in the secondary industry, and the proportion of men in this field has increased from 54% to 61.9%. Simultaneously, the proportion of women in the secondary industry has declined over time, from 50.3% at the beginning of graduation to 43.3% five years later. Women's gradual withdrawal from the secondary industry might be due to their intentions or the gender segregation in the industrial sector. Also, in above figures, no gender favours the primary industry, and its proportion is negligible. The primary purpose is to master professional talents, so central during the university is an essential factor for students to enter different industries after graduation. From this, we could guess that even though women's lack of advantage in the secondary industry may be related to their initial choice of university major (which lead them to get into the secondary industry), the gender inequality in the industry may accelerate this gap.

2.3 SUMMARY

The analysis results related to the student component highlight obvious and apparent gender differences and provide many insights into the areas of intervention and action needed to achieve gender equality. First, the number of women at the PoliTo is limited, accounting for about 30% of students' total number. According to the engineering and construction field classification, there is an apparent horizontal isolation phenomenon between disciplines. This situation has also subsequently affected the concentration of women in specific research fields. Among the new enrolment numbers, the number of female enrolments has increased slightly over time and has increased over time. On average, regardless of whether it is a bachelor's degree or a master's degree, female students have more top students than men and spend more minors. In another important aspect, the employment data of students graduating from PoliTo also shows noticeable gender differences and highlights the vertical and horizontal segregation. One to five years after graduation, women's employment rates and average wages are lower than men's, and the difference increases over time. Women are also segregated in specific sectors, mainly in the tertiary industry [20]. To understand the causes of these inequalities at the PoliTo, we still need further specific analysis and research.

3 Further analysis on interest of female by subjects

3.1 Majors setting and student performance by gender in PoliTo

Through the previous study, we have made a thorough analysis of the gender differences and the phenomenon of gender horizontal segregation and vertical segregation at PoliTo. However, to understand the causes of this phenomenon and the corresponding effective measures, in this chapter, the university's colleges and professional curriculum settings will be analysed and discussed. For further analysis, we move to different subjects' requirements to focus on the possible reason behind which might influence female students' choice of major. Since student's choice of career path has already started during the undergraduate project and largely determines their future work direction, in other words, the professional choice of graduate students will be a deepening of the degree of undergraduate study, so, in this chapter, we will adopt PoliTo undergraduate majors setting as the object of observation. According to PoliTo subject setting, university provides a unified basic curriculum in the bachelor freshman year, which are: chemistry, computer science, mathematical analysis I, English language 1st level, economics and business organization (only for industrial production management major), Linear Algebra and Geometry, and physics I. [24] These are the basic courses that almost all bachelor students will take regardless of their major. Entering the second academic year, different subjects have more detailed divisions, and the settings of professional courses are also different. Therefore, a comparison table of different professional programs for further comparison would be helpful.

At the same time, according to the 2020 Gender Report, there is no obvious problem of a low proportion of women in the field of architecture.[20] So, we would like to focus on other STEM subjects with gender imbalance in the PoliTo undergraduate program.

Table 3.1.1 Curriculum for different majors-part 1 (bachelor program)

Subjects	Major								
	Industrial production engineering	**Engineering and management**	**Chemical and food engineering**	**Aerospace engineering**	**Automotive engineering**	**Mechanical engineering**	**Energy engineering**	**Environmental and land engineering**	**Civil engineering**
Professional subjects	Management Control	Database	Engineering Drawing/ Drawing						
	Law and taxation / Human Resources management	Industrial Energy Systems	physical-chemical separations	Fundamentals of Electrical and Electronics	Applied mechanics and machines		Mechanics of machines	Electrical Systems	Analytical Mechanics
	Learning activities outside the University	Statistics	Thermodynamics for chemical engineering	Applied thermodynamics and heat transfer				Analytical Mechanics	Geology/Safety and Civil Protection
	Fundamentals of graphical communication and mechanical production	Economics and business organization	Fundamentals of organic chemistry, molecular biology and microbiology	Enterprise economics and management/Aeronautic law and human factors and safety	Science and technology of materials/Technology of metallic materials	Experimental Statistics and Mechanical Measurement	Introduction to electrical engineering/Electrical machines	Applied thermodynamics and heat transfer	Thermodynamics and Heat Transfer for Engineers
	Professional Training Materials for technological applications	Industrial electric systems	Control, instrumentation and safety for chemical processes	Fundamentals of structural mechanics		Fundamentals of structural mechanics	Building physics and HVAC systems	Environmental chemistry/Applied ecology	Science and technology of materials
	Operations research		Fluid machines	Mechanics of machines	Automatic control	Science and technology of materials/Technology of metallic materials	Computational laboratory for heat transfer and Fundamentals of machines	Circular economy and environmental sustainability	Structural Mechanics
	Energetics and Ecology	Production system	Structural Mechanics	Aerodynamics	Motor vehicle design	Fluid Mechanics	Structural Mechanics	Hydraulics	
	Database and company information systems	Industrial plants	Electrical circuits and Network Analysis	Aircraft constructions	Manufacturing and assembly technologies	Fundamentals of machine construction	Power plants and sustainability	Environmental engineering	Probability and statistics for engineering
	Quality management systems	Materials technology	Facilities for chemical and food industry	Fundamentals of machinery and propulsion	Fundamentals of machine design	Introduction to electrical engineering/Electrical machines	Applied energy and renewable sources	Topography	
	Marketing and prediction techniques	Private law	Science and technology of materials/Metallurgy		Fundamentals of electrical and electronic systems	Fundamentals of thermal and hydraulic machines and of fluid power	Science and technology of materials		Geotechnics
	Industrial plants and safety	Production scheduling and control	Industrial Chemistry	Aerospace on-board systems	Thermal Machines	Industrial plants and safety	Thermo-fluid dynamics	Applied Geology/Geophysics	Road infrastructures
	Plant integrated management	Distribution logistics	-	Fundamentals of flight mechanics	-	Manufacturing Technology	Elements of nuclear engineering	Structural Mechanics	Structural Engineering

Table 3.1.2 Curriculum for different majors-part2 (bachelor program)

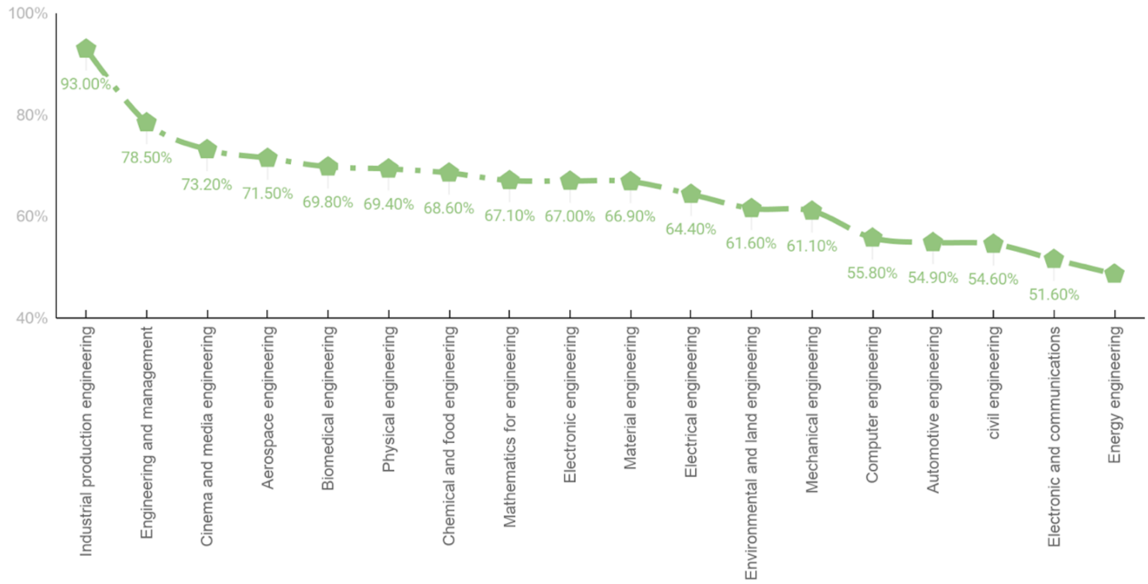
Subjects	Major								
	Mathematics for engineering	Material engineering	Electrical engineering	Computer engineering	Electronic and communications engineering	Physical engineering	Electronic engineering	Biomedical engineering	Cinema and media engineering
Professional subjects	Introduction to Algebra and Geometry	Engineering Drawing		Algorithms and Programming	Circuit theory and applications	Electrical circuits and Network Analysis			Cinema and Video
	Programming and scientific computing	Thermodynamics for materials engineering	Fundamentals of structural mechanics	Circuit Theory	Electronic devices				Interactive Media
	Analytical Mechanics	Organic Chemistry, Transport Phenomena and Safety	Electrical circuits and Network Analysis	Electronic systems, technologies and measurements	Automatic control	Advanced methods for physics and Quantum physics	Algorithms and Computers Architecture	Fundamentals of biology, anatomy and physiology	Digital Technologies
	Mathematical methods for engineers	Introduction to electrical engineering/Electrical machines	Applied thermodynamics and heat transfer	Introduction to databases	Electronic circuits				Object oriented programming
	Differential and Computational Geometry	Fundamentals of machines	Complex analysis and introductory statistics	Mathematical methods				Fundamentals of structural mechanics	Marketing and Media economics
	Discrete Mathematics	Science and technology of materials		Object oriented programming	Communication networks	Applied electromagnetics	Electromagnetic Fields and Waves	Mechanics of machines	Ethics and law of communications
	Probability and statistics	Mechanics of machines		Applied Electronics				Signal analysis	Signal analysis and processing
	Functional analysis/Partial differential equations	Fundamentals of structural mechanics	Electrical Measurement	Computer networks	Algorithms and Programming	Nuclear Physics with Biomedical applications	Electromagnetic fields	Applied thermodynamics and heat transfer	Signal theory and Signal processing
	Equations of Mathematical Physics	Metallic Materials	Electrical machines	Operating systems	Signals and systems	Solid state Physics	Signal processing and communications	Biomedical Transport Phenomena/Biomechanics	Mathematical methods for engineers
	Numerical methods	Polymeric Materials: Science and Technology	Fundamental of power electronics	Signal analysis and processing	Digital transmission and communication networks	Physics and Materials for Advanced Technologies	Automatic control	Active implantable devices/Medical images	Web Applications and Databases
	-	Science and technology of ceramic materials	Electrical Systems and safety	Computer architecture	Electromagnetic waves and antennas	-	Electronic measurements	Biomedical instrumentation	Computer graphics
	-	Structure of matter	Fundamentals of electrical drives	Automatic control	-	-	Measurement	Science and technology of materials	Computer networks
	-	-	-	-	-	-	Digital systems electronics	-	Image and video processing
	-	-	-	-	-	-	-	-	Transmedia
Common subjects		Mathematical analysis II							
		Physics II							

By comparing the collected subject information, we can see that almost all of the majors have two introductory courses: Mathematical Analysis II and Physics II in the undergraduate degree, so we can ignore that these two courses have different students' choices. Professional influence. Second, many majors have the same professional courses. For example, nine majors (energy engineering, automotive engineering, and so on) have opened engineering drawing courses; four majors (mechanical engineering and aerospace engineering) have opened applied thermodynamics and heat transfer course. This reflects the similarities between engineering expertise in different disciplines. In addition to specific personal hobbies, the degree of the same or similar courses in different professional disciplines may also affect students' choice of specific directions. Besides, we can also notice some curriculum settings that are significantly different from other majors. In industrial engineering and engineering management's undergraduate courses, social science disciplines are covered in the plan for some majors, such as economics, operations research, law, and some management courses. This is somewhat different from the "technological tendency" of most of the industrial engineering fields of the PoliTo.

Due to the different curriculum settings of different majors, the difficulty of the examination and the requirements for professionalism may constitute the difficulty of the entire major. Therefore, we would like to analyze different majors according to different factors. (Tables shown in Appendix)

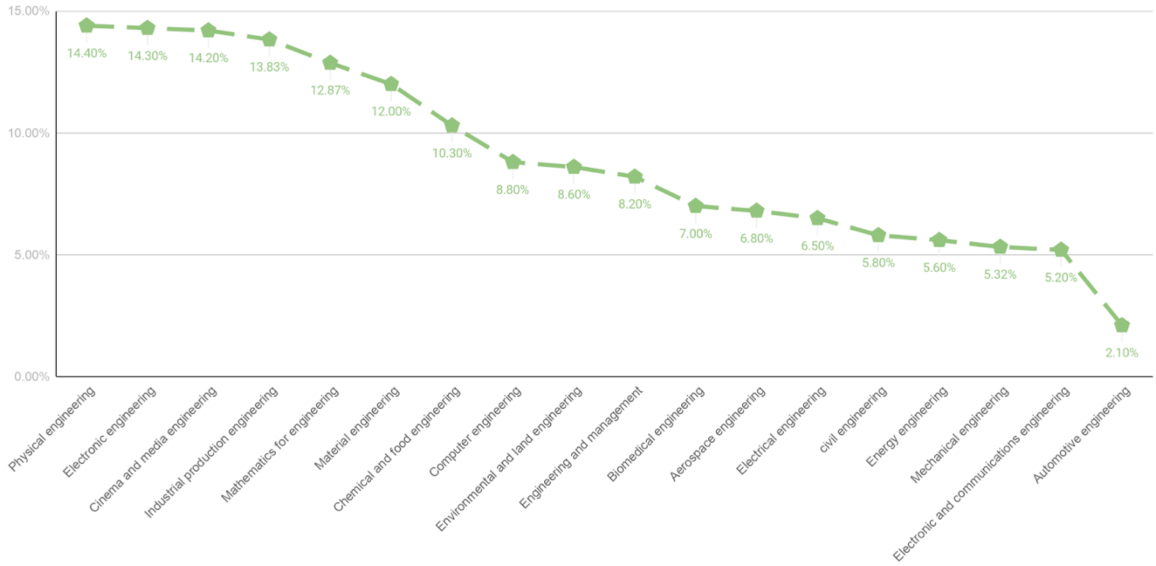
By analyzing the achievements of students of different majors, we have obtained results worthy of discussion.

Figure 3.1.1 Comparison of Exam pass rate by major in AY 2019/2020



From figure3.1.1, it can be seen that the major with the highest exam passing rate is the major of Industrial Production Engineering (93%), and the major with the lowest exam passing rate is the major of Energy Engineering (48.7%). The test pass rate is influencing factors that might include the difficulty of the question, the difficulty setting of the courses, and the degree of students' understanding. If we regard other factors as negligible, the test pass rate will be strongly influenced by the difficulty level of the course. In other words, we can consider that majors with relatively high passing rates are relatively less demanding than those with low pass rates.

Figure 3.1.2 Comparison of the rate of student getting full score by major in AY 2019/202



We also summarize the probability of students getting full marks for different majors. The information provided by the line chart is somewhat similar to our previous guess about the difficulty of the course. The top 3 easiest majors to get full marks are physics engineering, cinema and media engineering, and also electronic engineering all three majors reach 14% full score rate. Although it is not completely consistent with the line chart of the passing rate, the majors that are difficult to pass in the statistics of the exam pass rate often have a lower full score rate. The other end of the chart worth paying attention to is the lower full score majors, which are mechanical engineering, electronic and communication engineering and automation engineering. The full score rate of automotive engineering is the lowest among all majors, only 2.1%.

We can consider that students in these high rates of having complete score majors are more likely to get full marks than students majoring in other engineering fields. Therefore, if a student analyzes each major's examination situation and chooses his career path (regardless of his interest and industry development level), he or she can perceive that he chooses industrial production engineering, food and chemical engineering, and engineering management. Compared to other engineering fields, there may be a relatively relaxed learning experience and better results. Moreover, since the two graphs have very similar trends, this judgment will be applied to students pursuing passing exams and pursuing high scores or even full marks.

Table 3.1.21 Average exam passing rate and full score rate by college

College	Average Exam passing rate	Average full score rate	Percentage of female
Mathematical Engineering	67.1%	12.87%	36.7%
Management Engineering	78.5%	8.2%	34.9%
Chemical materials	67.8%	11.2%	40.9%
Chemical and food engineering	68.6%	10.3%	-
Material engineering	66.9%	12%	-
Mechanical, Aerospace, Automotive and Production Engineering	70.1%	7%	13.6%
Mechanical engineering	61.1%	5.32%	-
Aerospace engineering	71.5%	6.8%	-
Automotive engineering	54.9%	2.1%	-
Industrial production engineering	93%	13.83%	-
Biomedical Engineering	69.8%	7%	60%
Energy Engineering	56.6%	6.1%	23%
Electrical engineering	64.4%	6.5%	-
Energy engineering	48.7%	5.6%	-
Environmental and land engineering	61.6%	8.6%	43.5%
Civil engineering	54.6%	5.8%	27.8%
Computer Film and Phonon Engineering	64.5%	11.5%	15.4%
Cinema and media engineering	73.2%	14.2%	-
Computer engineering	55.8%	8.8%	-
Electronics. Telecommunications and physical engineering	62.5%	14.8%	19.8%
Electronic and communication engineering	51.6%	5.2%	-
Electronic engineering	67%	14.3%	-
Physical engineering	69%	25%	-
Electrical engineering	64.4%	6.5%	8%

By integrating and researching the test pass rates and perfect scores of different colleges and departments, the previous 2019/2020 data on the proportion of women in each college to analyze the situation is different from the previous assumptions. The department with the highest passing rate on the examination is the Department of Management Engineering. The proportion of female students in the department is 34.9%, ranking fourth among all STEM colleges. The department with the most significant proportion of female students in bioengineering is also the only subject in which female students account for more than half of all undergraduate programs. Even if we look at it from another direction, in the School of Electronic Engineering, which has a minor proportion of women, its test pass rate and total score rate are also at the middle level in all STEM colleges. Suppose we use these two ratios to represent the "difficulty" of a major or college. In that case, the above data shows that the major or college's difficulty does not particularly affect female students' professional choice. Consequently, some other reasons cause the difference in women's proportion in different majors to be so obvious. Most theories developed by sociologists, psychologists, educators, gender theorists, and underrepresented scientists in research engineering focus on personal and institutional factors and believe that women's educational experience will be influenced by gender perception differences, social bias, and personal interests.[23]

3.2 Analysis of different courses outlines among major

3.2.1 “care” and “provision”

Gender distribution data in different majors at PoliTo gives us an idea about the underlying factor and competencies affecting students' choice to choose a particular major. At the same time, STEM has strong competencies required. Despite being efforts made to have more inclusion of female students in universities, their number is decreasing; for instance, the number of female students in Biomedical engineering is 57%. In comparison, the male is 43% in AY 2019/2020. [20] The inclusion of females in this major is higher and related to the bias and stereotypical roles associated with gender. It is usually associated with the woman to have a natural role in medical care despite people associating these roles with no underlying proof or argument [25], the medical field suffers one of the most imbalanced gender ratio and roles as even in the medical field the hardcore of physically demanding jobs are associated with the male with knowledge-intensive and less physical demanding fields are dominated by female. Because engineering degrees have professional competence, and to determine the impact of professional competence on university majors and understand how gender factors affect them, it is advantageous to analyze further the PoliTo curriculum with the concepts of "Care" and "Provision." "Care" is for women, and "Provision" is for men. This view analyzes domestic production and gender division of labor from a feminist perspective and shows the critical direction of gender research in the labor market. In other studies, the gender perspective has also been more in-depth exploration and research. As we mentioned earlier in Tazo's view [9], the professionalism perspective can be divided into basic, general, and technical aspects. Therefore, we will comprehensively judge professional ability from these three aspects and divide the course description of PoliTo with gender concepts of "Care" and "Provision."

3.2.1 Course's outline

1. **Energy engineering**

- **Educational objectives:**
- This program is characterized by solid interdisciplinarity with the other sectors of Industrial Engineering. In the framework of which it falls, it mainly provides a robust basic knowledge in thermodynamics, power plants and electric machines, material technology, structural mechanics, heat transfer, and fluid dynamics. [27] Based on this professional knowledge, expertise in the following areas can be cultivated: energy topics, namely the primary industrial and civil energy plants, renewable energy, calculation of heat transfer, building physics, and basic knowledge of nuclear technology.
- **Career opportunities:**

The professional profile of the energy engineer falls within the more general area of industrial engineering. [27]

After the bachelor program, energy engineers can study and manage the components, equipment, and systems used to generate and use thermal, mechanical, and electrical energy from fossil energy and renewable energy when they deal with the resulting safety and environmental impact issues. Graduates will also have the ability to plan and rationally use energy in the industrial, civil, agricultural, and transportation sectors.

- **Professional profile:**

  Junior energy engineer

2. Industrial Production Engineering

- **Educational objectives:**

The academic aims of the Graduate Program are:

knowledge of the methodological - primary activities of project and management to identify and resolve disputes involved in the management of corporate technologies

computer science and IT knowledge to identify and settle problems related to a company's IT knowledge of the legal, economic, and commercial aspects of an enterprise's activity globally and locally. [28]

The ability to analyze, interpret and manage technical, operational, business, and trade matters related to companies and their relationship with the global market can work independently and successfully cooperate even in international working groups. Knowledge of two foreign languages and the ability to use them in cultural contexts typical of the program. Preparation to continue studies in the reference master's degree.

- **Career opportunities:**

The major of technology and international business is cultivating talents who can understand and operate in the domestic and international business environment. Can participate in industrial and service industries in Italy and abroad, such as design, work, and safety organization, and economic analysis; logistics, quality and certification management; resource and personnel management in the technical field; and responsible for manufacturing companies in domestic and international trade Purchasing, marketing, and sales, Etc. [28]

- **Professional profile:**

Junior production engineer, company IT design and management officer; cost analysis, and business management controller; sales & marketing officer; human resources (HR) support officer; quality and environmental control officer; production management officer; production plant designer; plant management office.

3. Engineering and management

- **Educational objectives:**

This project aims to train students who serve as company operations managers in the future. Graduates will have the ability to use standard analysis tools in industrial engineering and production and to apply information systems and IT knowledge to support company operations. Also, students will have professional skills in these two teaching fields. These fields match the two typical professional profiles required by the job market for industrial engineering and management (IEM) graduates.

- **Career opportunities:**

Employment and career development opportunities for graduates are in process design, internal and external logistics processes (distribution and power supply), in the field of organizational analysis and management of information systems, in private companies or public institutions.

- **Professional profile:**

Information Systems - IS Auditor (or assistant auditor)

4.Automotive engineering

- **Educational objectives:**

Automotive engineering aims to train students to become product engineers and process engineers who solve highly interdisciplinary systems. It mainly focuses on machinery, heat engine, electric motor, power and control electronics, and production technology fields. The professional abilities that students will have after three years of study are as follows: Research on vehicles, their main subsystems, and their system-level capabilities for production; Understand the electrical system of motor vehicles; Understand vehicle performance and its main components; Understand the production and assembly process; Know the controls and their applications; Master the basic knowledge of electric vehicles; The ability to apply the knowledge gained in the design of auto parts; The ability to work in an interdisciplinary team. [29]

- **Career opportunities:**

Become a professional engineer in the automotive field.

5. Territorial, urban, environmental and landscape planning

- **Educational objectives:**

This degree program aims to train "regional technicians" with the following abilities: assist in the formulation of regional, urban, environmental, landscape or sector plans of various scales, as well as the definition of integrated technologies, implementation and management of regional and urban transformation and renewal Plans and projects, in the development of planning analysis, and so on. The learning plan of this program follows the territorial government, town and land use planning, landscape and environment, and geographic information system (GIS) three directions, and two teaching modules (UD) and multidisciplinary studio (UDA) [30].

- **Career opportunities:**

Due to the increasing demand for talents due to increasingly widespread environmental issues, graduates will seek employment in local authorities (municipalities, provinces, regions), municipal companies, and professional companies operating in the areas of regional, urban, landscape, and environmental planning. However, the course is not qualified to require graduates to hold positions of supervision, management, or coordination of such activities: these functions are reserved for graduates of the master's program. Graduates can also participate in freelance activities. After passing the national examination, they enter the B-level professional positions of the Architects, planners, landscape architects, and conservators' professional committees and are named "junior planners".

- **Professional profile:**

Collaborator in the growth of economic, territorial, environmental, and landscape plans at various scales; collaborator in the design, implementation, and management of integrated and environmental regeneration programs; collaborator in the field of territorial and environmental analysis, evaluation, and conducting audits; and consultant in the field of territorial and ecological analysis, evaluation, and monitoring activities;

Designer and manager of GIS for urban a territorial analysis and management; Designer and manager of geographical information systems.

6. Civil engineering

- **Educational objectives:**

The Bachelor of Civil Engineering program aims to train professionals and foundations with specific knowledge and skills such as design, implementation, management, measurement, control, and maintenance of buildings (civil and industrial) and large structures (bridges, dams, tunnels) Facilities (roads and transportation systems, water collection, distribution and treatment systems). Meanwhile, the plan also provides essential guidance on security and civil defense to supplement. Students of this major receive basic course training in the first and second years during the three-year bachelor program and start professional training in professional civil engineering in the third year. [31]

- **Career opportunities:**

This program includes traditional skills and innovation development following a global and domestic environment. Civil engineering graduates can engage in professional activities that are mainly responsible for third parties after passing the state examination and joining the engineering profession (becoming an Italian B-level engineer). The work content includes support activities in design, implementation, management, measurement, testing, and maintenance of buildings, large-scale public works, and infrastructure. Public and private technical departments, construction contractors, and engineering companies are all likely to provide graduates jobs.

- **Professional profile:**

Civil engineer: or Civil engineer, qualified in design

7. Chemical and food engineering

- **Educational objectives:**

In the first and second academic years, students of this significant offer two introductory courses: scientific foundation (engineering-related mathematics and basic science) and engineering foundation (typical industrial engineering content) to train students to use the latest methods, technologies, and tools to identify, the ability to formulate and solve problems. Simultaneously, special training is provided for students' knowledge and skills in industrial technology design, material science and technology, structural mechanics, machine mechanics, and electrical engineering. In the third year, some essential engineering topics common to industrial engineering (the foundation of structural mechanics and mechanical mechanics) and exceptional guidance for chemical engineers (interdisciplinary laboratory) began.

- **Career opportunities:**

The program aims to enable graduates to use the correct technical language and basic concept knowledge to conduct dialogues with other chemical industry departments and information technology engineering to be competent for outstanding jobs in a wide range of chemical engineering. This primary curriculum is sufficient to ensure that graduates who pass basic course training can continue studying for a master's degree or directly enter employment. The skills acquired by chemical engineers enable graduates to easily find jobs in the chemical, pharmaceutical, petrochemical, and petroleum industries, and more generally in the processing and transformation industries (especially food-related industries) in the broadest sense. Traditionally, chemical engineering graduates usually operate competently and flexibly in various industrial engineering activities of companies, private entities, and public administrations. They are sometimes required to solve environmental and energy problems, but they are maintained in the chemical field. Professional field. May work in industrial laboratories, public management technology departments responsible for industrial safety and environmental protection, and consulting and design companies. After passing the B-level Italian exam, chemical engineers can become junior engineers, register in the industrial category, and engage in professional activities.

- **Professional profile:**

Chemical engineer; industrial engineer; Technical Sales officer; Laboratory technician

8. Aerospace engineering

- ## Educational objectives

The program is divided into the following models: basic science and methodology, general engineering, aerospace engineering, aviation maintenance and industry background knowledge, and final exams. On the whole, the setting of majors not only ensures that students have solid professional quality and knowledge reserve but also provides students with a global perspective required by the nature of aerospace engineering in combination with the development of the times and is a solution to deal with the increasingly important economics in the aerospace business, regulations, environment, and other related issues.

- **Career opportunities:**

professional setting has shifted from the previous industrial engineering to more fields, especially the design, production, and management of aerospace products. Modern aerospace engineering is a kind of systems engineering, and it is increasingly necessary to integrate all the elements in the design or management of aircraft or spacecraft. Although aerospace engineers have a variety of expertise, their knowledge base is not specialized. The ultimate goal of creating aviation or aerospace products is not to reduce the scope of training required but to expand its scope. Even in a professional context, aerospace engineers must be able to form an overall impression of all aspects of the problem, collect knowledge from disciplines that are usually far apart, and apply it to the general environment in which the product is located. The aerospace engineering bachelor's degree program aims to cultivate. Therefore, this degree program is built on a broad interdisciplinary basis, sometimes deviating from the narrow industrial engineering field (including, for example, the indisputable electronics in aerospace), and sometimes involving various disciplines, including the specific discipline aviation industry (To a lesser extent, it is the aerospace industry, which will be covered more fully during the MSc program), and the industry that enables system engineers to establish dialogue with experts in the continuous field.

The employment opportunities for graduates of aerospace engineering are mainly in the aerospace field itself.

- **Professional profiles:**

Maintenance Engineer; Designer

9. MECHANICAL ENGINEERING

- **educational objectives:**

The mechanical engineering course trains students with basic knowledge in industrial engineering and special mechanical skills. After three years of undergraduate study, graduates will have the following abilities: basic knowledge of chemistry and physics, as well as mathematical and computational tools for engineering applications; basic technology and method knowledge of industrial engineering; good skills in the field of mechanical engineering: materials, Design, thermal fluid dynamics, thermal and fluid machinery, production technology, industrial plants, and related technical services; suitable for individual and team cooperation; have the ability to communicate with professionals in different engineering fields using appropriate technical languages, and constantly update Innovative ability.

The course setting can be divided into the first year of primary science education (mathematics, chemistry, physics, and computer science), the second year of basic engineering training (industrial fields, such as technical drawing, thermodynamics, Etc.), and the third year of specific engineering Training (mechanical engineering field. Such as mechanical Design, fluid mechanics, Etc., three main areas. [32]

- **Career opportunities:**

After the bachelor program, graduates will have enough professional skills to continue their studies in specific areas, or they will quickly integrate into the workplace with their continuous improvement of professional skills and have the ability to adapt to various professional backgrounds. Mechanical engineering graduates will find employment opportunities. There is a wide range of employment industries, mainly are companies that design, produce and maintain machinery and electromechanical components, such as manufacturing and processing companies that use machinery, metallurgy, and electromechanical production systems; for energy conversion Companies and public utilities; transportation companies; service and industrial consulting companies; or public institutions with technical tasks.

- **Professional profiles:**

Junior Mechanical Engineer, product design and maintenance officer; Junior mechanical engineer, design and process officer; Junior Mechanical Engineer, production officer; Junior Mechanical Engineer, industrial plant design and maintenance officer; Junior Mechanical Engineer, industrial plant management officer; Junior mechanical engineer technical sales services officer; Junior Mechanical Engineer, industrial plant design and maintenance officer, specifically for the textile industry.

10. Material Engineering

- **Educational Objectives**

This course's curriculum is designed by linking interrelated thematic areas such as general engineering, Material engineering, and other scientific and methodological foundations. The first year is shared with other engineering majors and follows the scientific and methodological foundations. The second year is more focused on general engineering and includes introductory courses about science and technology of materials and related mechanical engineering courses of machinery, thermodynamics, and heat transfer. The final year of undergraduate studies is devoted to developing strong expertise in materials, the technology of polymers, and functional materials. Students freely choose few subjects on topics such as computer science, safety/security issues, economics, legal and historical topics. [33]

- **Career Opportunities**

The undergraduate program in Material engineering has an interdisciplinary approach, allowing material engineers to repetition to a widespread demand for professional activities in materials, mechanical and civil engineering, to name a few. Materials engineers know structural and functional materials and enable them to take professional roles in the industrial engineering sector. Material engineers are primarily employed in Public and Private industries and have technical and managerial positions; also, freelance consultant or professional or a salaried employee in a consultancy firm is a dominant professional position for a material engineer.

- **Professional profiles:**

Material engineer, working in industrial sector; Material engineer operating as a freelance consultant.

11. Electrical Engineering

- **Educational Objectives**

This major is designed to train industrial engineering professionals with a specific emphasis on electrical systems and components. This program enables students to have a solid grasp of numerous electrical engineering fields by providing them cross-training in electrical machines, electromechanical applications, power electronics, electrical measures, and electric operations. These programs help students understand the impact of engineering solutions applied to electricity and its environment. The bachelor's program in electrical engineering follows the same interdisciplinary trend as several other majors. The first years consist of essential scientific areas, containing the basics of Mathematics, chemistry, and physics. The second year consists of more complex analysis that makes a solid foundation for students to understand electrical systems and components' nature. The essential engineering area of the electrical engineering program is broader compared to other industrial engineering programs. There are dedicated modules related to electrical engineering, and support subjects consist of statistical concepts, automation, and power electronics. The final year further deepens students' knowledge in electrical engineering. It offers IT training, with students choosing a few courses in economics, data science, and emerging themes in electrical engineering.

- **Career Opportunities**

The major is designed to make professionals in a general industrial engineering context, enabling individuals to have sound expertise in installation and electrical sectors. The programs have a methodological operative aspect that enables graduates to use their technical knowledge and language to collaborate and dialogue with individuals of other functions. There are vast career opportunities available for electrical engineering graduates. The most common industrial sector is Electric energy production stations and power grids; Electric energy distribution lines and power stations; Service sectors, industrial plants, and domestic setting; Electromechanics. [34]

- **Professional Profiles:**

The typical career profiles of after studying this major at PoliTo are: Freelance consultant (have to pass state exam); Technical Service Manager; Technical officer or Lab officer; Collaborator in System Design; Technical Sales officer

12. Computer Engineering

- **Educational Objectives**

Computer engineering major provides students with a basic notion of engineering and deep insights into the main characteristics of information systems, regarding both hardware and software; it covers the topics about computer architecture and processing systems, and also techniques regarding software engineering, principle, and technologies for modeling, designing and managing databases.

This course's curriculum has three significant aspects: first is having a solid foundation in core engineering subjects such as physics, mathematics, and chemistry. The second aspect is correlating with electrical and electronic engineering, allowing students to understand electronic devices' working and the principle guiding them. The 3rd aspect concerns computer engineering's specialized contents and its relationship with telecommunication, with emphasis on object-oriented programming and designing computer networks. The theoretical knowledge is strongly backed by laboratory work to enable students to solve real-world problems using proprietary and open-source software. [35]

- **Career Opportunities**

The sector is dynamic, with fast pace innovation taking place every day. New fields such as cloud computing, data analytics, Augmented reality, virtual reality, and artificial intelligence are very new fields presenting a wide range of opportunities. Computer engineering degree equips graduates with skills and knowledge base to solve and innovate IT words and make tech available to end-users. Industries in almost every sector cannot ignore the importance of computer engineers. The most common industrial sectors are financial companies, commercial companies, and tech startups, e-commerce.

- **Professional Profile:**

Hardware system engineer; Application and system software analyst and designer; Computer network system Engineer

13. Electronics and Communication Engineering

- **Educational Objectives**

The program is a balanced combination of computer, ICT, electronic, and introductory engineering courses. This major put a significant emphasis on Physics, advanced mathematics, and electronics systems. Students specialize in numerous ICT topics in the third bachelor's program and learn advanced algorithms and programming techniques, communication networks, and advanced electronic systems. This bachelor's program is diverse, and after graduating, students can choose among the several master's programs in the ICT area, nanotechnology, and computer related subjects. [36]

- **Career Opportunities**

The sector is emerging with more and more opportunities offered in many industries; consulting, data communication, R&D, and aviation are named a few.

- **Professional Profile:**

Signal processing engineer; Telecommunication engineer; VLSI (Very large-scale integration) engineer; Instrumentation engineer; Control engineer

14. Physical Engineering

- **Educational Objectives**

The first year and first semester of the second year familiarize students with mathematical methods and basic scientific notation related to engineering. The second year enables students to understand basic skills in information engineering. The 3rd year is more specialized and focuses on complex systems, solid-state physics, quantum, and statistical methods. Courses offered in the third year allows students to make full use of basic scientific and engineering concept.[37]

- **Career opportunities**

Physical engineering has a wide range of opportunities. If combined with a specialized master, it narrows down the career path, leading to a more precise opportunity in academia or the industrial sector. Most physical engineers work in other heavy mechanical industries such as the Aerospace industry or the organization's Research and Development sector.

- **Professional Profile:**

Process engineer, production process; Application Engineer complex system; Simulation Engineer；Material Engineer; Research Engineer

15. Biomedical Engineering

- **Educational Objectives**

This course aims to provide training to individuals on medical devices so that they can bring their technical knowledge to the design and production processes. The major has a thematic and interdisciplinary approach to continue their studies further, bringing innovation to the work environment. The significant shares the first year and first semester of the second year with other majors; during the second year, the focus is on broad health courses such as biology, anatomy, and physiology with few courses related to technical fields such as information engineering. Students are trained in basic engineering in the third year through courses in material science and thermodynamics. This year also introduces the legal studies about safety aspects and operating principles of primary medical devices. The more rigorous courses teaching management and development of health systems, the principle of ergonomics, instrumentation for the acquisition of medical images, Etc., are taught with practical training.[38]

- **Career Opportunities**

Graduates usually find employment in the healthcare system, doing research and development in industrial production. A significant portion of graduates works for companies that market medical devices and work as a sales assistant; furthermore, Clinical engineering companies attract a significant portion of graduates a junior biomedical engineer.

- **Professional profile**

Designer of medical devices; Sales assistant in Healthcare sector; Consultant in Biomedical field; Researcher; Freelance; Hospital manager of devices

16. Cinema and Media Engineering

- **Educational Objectives**

The major has a multi-disciplinary approach. It combines knowledge from social sciences, media, cinema, information engineering, programming languages, graphics, 3d modeling, and sound design.

The first year is familiar with other engineering programs and follows introductory courses in chemistry, mathematics, and physics; in the second year, training in IT, electronics, and advanced mathematics is offered. Also, media economics and production techniques are taught. The third year is more focused on specific content related to media and cinema engineering. Students learn more advanced skills in computer graphics, databases, and web applications. [39]

- **Career Opportunities**

The degree in cinema and media engineering equips students with technological applicative skills related to engineering and combines them with the world of communication and culture. Graduates can handle multimedia projects and define a marketing plan and identify strategies for promoting audiovisual products. Most graduates work in Design, creating content in various sectors, i.e., Cinema, television, and Multimedia.

- **Professional Profiles:**

Multimedia Designer; Web Producer; Computer graphics Analyst

17. Electronic Engineering

- **Educational Objectives**

The first year has introductory engineering courses such as chemistry, physics, and Mathematical analysis. Second-year courses are related to information technologies and are more specialized in electrotechnics, general electronics, and measurements. The third year follows an interdisciplinary approach and combines courses from telecommunication and automation with an in-depth study of electronics. [40]

- **Professional Profiles**

Junior Designer, in context of electronic circuits; Production Engineer: as a manufacturing engineer in electronic industry; Technical-Commercial expert; Junior service and maintenance engineer; Electronic laboratory manager; Professional consultant

18. Mathematics for Engineering

- **Educational Objectives**

This bachelor’s program of Mathematics for Engineering has three main aspects: first, it develops the scientific and operational foundation of basic mathematics; secondly, it enables students to have a deep understanding of mathematics and computer science methods; it also develops a strong engineering foundation.[41]

- **Career Opportunities**

Graduates can find employment in the industrial sector working on mathematical models for industrial processes, also as data analysts.

3.2.2 Professional competences analysis

Table 3.2.2 Professional competence

Major	Competences	Professional profile	Competence's type	Care/Provision
Energy engineering	-ability of study and apply the knowledge of energy - ability to assess the resulting safety and environmental impact issues	-Junior energy engineer	T G	Provision
Industrial Production Engineering	-ability to identify and solve issues related to the management of business processes and technology - ability to analyze, interpret and manage technical, operational, business and trade matters related to companies and their relationship with the global market - the ability to work independently and collaborate effectively -ability to deal with change and hence a solid motivation to stay abreast with a continuous knowledge updating	-company IT design and management officer -cost analysis, and business management controller -sales & marketing officer -human resources (HR) support officer -quality and environmental control officer -production management officer -production plant designer -plant management officer	T G	Care Provision
Engineering and management	-ability to use typical analysis tools in industrial engineering and production and to apply information systems -have enough IT knowledge to support company operations	- IS Auditor -IS assistant auditor	B T	Provision
Automotive engineering	-ability of research on vehicles, their main subsystems, and their system-level capabilities for production - Understand the electrical system of motor vehicles, vehicle performance and its main components -Understand the production and assembly process, the controls and	-Automotive engineering	T	Provision

	their applications -The ability to apply the knowledge gained in the design of auto parts - The ability to work in an interdisciplinary team			
Territorial, urban, environmental and landscape planning	- ability to design and manage, integrate, analysis and apply the knowledge of regional, urban, environmental, landscape - ability of renewal, evaluation and monitoring plans and projects	-Collaborator in the production of urban, territorial, environmental and landscape plans at various scales -collaborator in the field of design, implementation and management integrated spatial and environment regeneration programmers, territorial and environmental analysis, evaluation and monitoring activities -Designer and manager of GIS for urban and territorial analysis and management/geographical information systems	G T	Care Provision
Civil engineering	-ability to design, implement, manage, measure, control and maintain buildings (civil and industrial) and large structures (bridges, dams, tunnels) -ability to build infrastructure (road and transportation system, water collection, distribution) and treatment system	-Civil engineer -Civil engineer, qualified in design	T	Provision
Chemical and food engineering	-ability to formulate and solve chemical and food problems and further apply -ability to analyze the safety of industrial processes, occupational health, fire and explosion risks, and out-of-control reactions -ability to analyze and study heat transfer, mixing, pumping, control, fluidization, etc.	-chemical engineer -industrial engineer -Technical Sales officer -Laboratory technician	T G	Provision Care

Aerospace engineering	-ability to understand and apply professional knowledge reserves -possess the global vision required by the nature of aerospace engineering combined with the development of the times -ability to establish solutions to the economics of aerospace business -ability to apply related laws and regulations, environment and other related issues	-Maintenance Engineer -Designer	G T	Provision
Mechanical engineering	- basic technical and methodological knowledge of industrial engineering, as well as good skills and applications in the field of mechanical engineering -ability to provide materials, design, thermal fluid dynamics, thermal and fluid machinery and other related technical services -ability to communicate with professionals in different engineering fields and work in teams using appropriate technical languages -Possess the innovative ability to keep pace with the times	-Junior Mechanical Engineer -product design and maintenance officer -design and process officer - production officer - industrial plant design and maintenance officer - industrial plant management officer -technical sales services officer -industrial plant design and maintenance officer,	T G	Provision
Material Engineering	-Possess general engineering, materials engineering and other basic scientific knowledge and application capabilities	-Material engineer, Working in industrial sector -Material engineer operating as a freelance consultant	G T	Provision
Electrical Engineering	-Ability to solve power applications and environmental engineering -Understanding and application of basic knowledge of electric power	-Freelance consultant (have to pass state exam) -Technical Service Manager -Technical officer or Lab officer -Collaborator in System Design Technical Sales officer	T G	Provision
Computer Engineering	-Understand and apply the working principles and principles of electronic equipment to real life -ability to perform programming and computer network design	-Hardware system engineer -Application and system software analyst and designer -Computer network system Engineer	G T	provision Care

Electronics and Communication Engineering	-ability to comprehensively use computers, ICT, electronics and basic engineering knowledge -ability to conduct in-depth research in the field of ICT, nanotechnology and computer related disciplines	-Signal processing engineer -Telecommunication engineer -VLSI (Very large-scale integration) engineer -Instrumentation engineer -Control engineer	G T	Provision
Physical Engineering	-basic skills in information engineering -Understand basic science and engineering concepts -Ability to study complex system physics, solid state physics, quantum and statistical methods	-Process engineer, production process -Application Engineer complex system -Simulation Engineer -Material Engineer -Research Engineer	T	Care Provision
Biomedical Engineering	-basic knowledge of medical devices and have the ability to skillfully use technical knowledge in the design and production process. -ability to conduct in-depth research in biomedical and related fields	-Designer of medical devices -Sales assistant in Healthcare sector -Consultant in Biomedical field -Researcher -Freelance -Hospital manager of devices	T	Care Provision
Cinema and Media Engineering	-Possess professional knowledge of social science, media, and film -ability to use information engineering, programming languages, graphics, 3D modeling and sound design tools.	-Multimedia Designer -Web Producer -Computer graphics Analyst	G T	Care Provision
Electronic Engineering	-Thorough understanding and application of basic engineering concepts and the main characteristics of electronic components, equipment and systems and their applications -ability to interact with mathematical models and experimental reality	-Junior Designer, in context of electronic circuits -Production Engineer: as a manufacturing engineer in electronic industry -Technical-Commercial expert Junior service and maintenance engineer -Electronic laboratory manager Professional consultant	T G	Provision
Mathematics for Engineering	-ability to use scientific knowledge to prove prohibition and ultimately solve engineering problems -ability to build mathematical models to deal with industrial processes and natural phenomena, manage, organize and analyze data	-data analyst -mathematical engineering -mathematical engineering (industrial processes) -Junior manager of consulting company	T G	Care Provision

	-ability to Improve experiment and apply mathematics and use IT methods to solve problems	-Consult of banks and insurance companies		

After detailed insight about a different major in the industrial engineering program at PoliTo, by further studying the educational objectives and professional profile we categorize the competencies whether they are the provision of care, we concluded that ten out of eighteen centrals have to provision competencies following the definition, description of the course and the professional profile of individual after undertaking this major. By looking at the description, of course, the provision competencies definition is dominant that up to a certain degree might influence females' decision to not participate in these majors. The same findings were also found in research conducted by Maria Immacula (2020) [9]. Several measures, such as woman info week, Etc., are put in place to enhance females' inclusion in industrial engineering programs.

3.3 Discussion on the reasons why women don't favour STEM majors

The low participation rate of female students in STEM subjects might be the result of multiple reasons. After trying to analyse the social environment and personal psychology, the following possible incentives are obtained:

1.Lack of confidence in STEM

Traditionally, women have lower levels of self-confidence in mathematics and science abilities than men. Most of the time, girls are more affected by negative grades than boys when deciding their future, especially STEM.[42] A very similar view was also pointed out by Kathrine, an assistant professor from Harvard Business School. She believes that this weak self-confidence may cause some women to retreat because they do not want to pursue prestigious careers, even though they have the skills to succeed, but they do not think they will excel.[43] In the long run, this lack of self-confidence and engineering self-efficacy has largely hindered women's development in the engineering field.[42]

The determination and confidence to engage in this profession will essentially lead to the success of the profession. Lack of confidence in mathematics and science abilities prevents many women from studying engineering before entering university. Even this gap in confidence between the sexes prevents women from completing undergraduate degrees in engineering. Take PoliTo as an example; every year, many girls transfer from engineering majors to architecture majors. Some people believe that girls' self-confidence will decline due to poor performance in the STEM field. However, there is evidence that even if their engineering course performance is similar to that of men in the same class, girls' self-confidence still lags behind men. [44] Although more and more studies have shown that the difference in average mathematics scores between boys and girls in ordinary schools no longer exists.[45] However, cognitive gender differences, including mathematical ability, are still controversial. Lynn and Irwing (2004) found little or no difference in average IQ between the sexes.[46] This is also in line with our previous observations that girls will not avoid more difficult courses when choosing a major. Therefore, there is no reason to distinguish between male and female professional choices based on intellectual reasons.

2. Passion and ambitions

Passion is another hugely important factor worth considering in career choices. The more people are interested in their work, and the more likely they are to succeed. In other words, when everything else is the same, the more similar the interests of individuals and those of successful people in the field, the more likely they are to succeed. Career interest tests follow this principle: they predict the likelihood of an individual's success by measuring a set of interests similar to or similar to those of successful people in the field and then suggest that individuals consider careers in their fields of most significant interest. Due to different interests, men and women have very different professions. Many girls have dreams of becoming nurses, models, teachers, Etc., in their childhood, and these dreams more or less affect their later career choices; for boys, they often dream of becoming physical Scientists, scientists, Etc.

When they were young, many girls' interests have already been affected by the emphasis on feminization in socialization. In the research on gender roles, masculine traits and feminine traits usually represent two types of traits with different adaptive values in different situations. The primarily former refers to traditionally used to describe the good qualities of men in terms of agency (such as independence, self-confidence, aspiration, etc.; the latter refers to traditionally used to describe the good qualities of women in terms of communal, such as Considerate, enthusiastic, helpful, etc. Masculinity is usually conducive to realizing personal achievement and has instrumentality, while femininity is usually conducive to the construction of harmonious relationships and has expressiveness.[46]

3. Future expectations

The factor hindering the career development of women is also including cognitive differences. Because females are psychologically different from males, these differences will prevent women from being promoted to executives and other senior positions. In specific fields of science and engineering or areas where physical strength dominates, women are considered to have no talent or lack of other qualities, which will seriously undermine women's enthusiasm to develop this industry. Simultaneously, when an industry dominates the gender as men, women often choose to avoid this industry because of concerns about promotion space and unequal treatment. This phenomenon can be said to be a restriction on women caused by the external environment. According to the Final report of WECE (Women's Experiences in College Engineering), a lot of young women leave STEM majors not because they cannot do the work (a misperception that has been common among engineering faculty), but for reasons other than academic ability. These reasons may include their negative evaluation of performance may be pretty good, decreased self-confidence, or unwillingness to spend all their waking time on "doing engineering." [47]

4. Less difficulty on future financial

Salary level is an essential factor affecting career choices; even for many people, the salary is their first choice while job hunting. According to statistics, the highest salaries for Italian master graduates are in engineering fields.[48] This can explain from another direction why there are so many engineering graduates over the years. Simultaneously, almost all disciplines in the STEM field are more likely to get higher salaries than traditional social science disciplines, such as biologists, chemists, and automotive engineers. According to the Gender Pay Gap Report for 2020, Most of the time, Men are more inclined to high salaries and high positions when looking for jobs, and Women are more likely to take a break during their careers to have children or seek lower-paid positions. [49]

In other words, women are more likely to find positions that provide greater flexibility to facilitate their careers, which in that case, family management and dedication are easier for them. Both of these concepts among men and women have been influenced by the socialization of gender roles. For example, traditionally, men should take on the responsibility of "making money to support the family," while women should do more to "nurture children" and "clean up housework." From an extended point of view, women are less worried about the external financial crisis than men.[50] Furthermore, this concern will push men to pursue more high-paying jobs, such as engineers, doctors, and biologists. Although these traditional ideas are unfounded and are not conducive to long-term social development and provide many obstacles to gender equality, it is not that easy for people and industries, even whole society, to eliminate this gender bias.

In summary, there are a couple of reasons why women are in a disadvantaged position in STEM disciplines. Perhaps it is the bias and constant denial of the outside environment (Although in many cases, the source of these prejudices is unfounded and is a long-term unconscious behavior, this prejudice hinders the success of women in the engineering field) , or self-evaluation hinders them from further pursuing science or engineering[51], also might be their lack of interest and concerns that men dominate, or the inability to develop the field, etc., these reasons combined have led to the problematic development of women success in STEM subjects.

4 Observations

The lack of women in STEM is a problem that is very worthy of attention, but it will undoubtedly require a lot of long-term efforts to solve this situation. Enabling women to get more opportunities and fairer treatment is conducive to promoting the faster development of science and social harmony. This is also a problem that many countries and organizations are trying to solve.

1.Use the power of role models

Given that women are easily affected by the external environment using more accomplished female scientists in the learning environment to set their example might be a good choice and guide girls to explore bravely, not afraid of setbacks, and learn more about science-related stories. Girls cultivated their interest in science from early childhood. The value of guidance is irreplaceable. Finding a mentor early can help girls build confidence and further translate into professional satisfaction; especially for women in an unstable work environment such as engineering, working with a mentor is a career strategy that can positively impact. Also, positive praise from successful women and helpful study guides can enable female students to achieve scientific success more quickly and easily [51]. According to some researchers, female role models are more effective in promoting women's retention in these fields.[53]

2. Cultivate girls' interest in science since childhood

If we want to explore why there are so few women choosing STEM subjects in universities, to a large extent, we cannot ignore that this gap has appeared in an earlier period. According to the surveys of Diana, Margherita, and Chiara (2018), 70% of male students have studied STEM subjects in Italy high school, while the proportion of women is only 40%. [54]

3. The efforts of schools, educational institutions and all sectors of society

The achievement of gender equality is closely related to the efforts of the entire society. The first and most closely related are educational institutions. The first and most closely related are educational institutions such as schools. Starting from elementary school, schools should pay special attention to the cultivation and encouragement of women's interest in science and engineering and create an intense atmosphere of curiosity for girls. Simultaneously, during the critical period of choosing a major, the school should also provide relevant answers and guidance and provide appropriate suggestions based on the girls' interests and advantageous subjects. Universities can also promote gender equality, such as setting up special scholarships for girls to ensure fair interaction and teaching in the classroom and reduce stereotypes. Alternatively, adopt a more convenient exchange plan so that girls can accept more opinions and counseling from female professors. PoliTo is making these attempts and efforts. For example, the latest gender research report is released every year, as well as more STEM subject science popularization before entrance exams to attract more female students and various activities to support women, such as STEM by women (2019) many more.

Also, many social organizations are working hard to promote gender equality and eliminate society's prejudice against women. These organizations are committed to provide more opportunities for females and strive to make some people aware of and correct subconscious bias. These actions would be conducive to the process of social diversity and gender equality.

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Appendix

Table 3.1.3 Curriculum for Industrial production engineering grades in AY 2019/2020 (bachelor program)

Industrial production engineering						
Subject's name	**Exam pass rate**			**Full score rate**		
	professor 1	**professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score student rate**
Enterprise laws	-	-	92%	-	-	16.7%
Mathematics and Physics	-	-	74%	-	-	2.0%
Business management	-	-	86%	-	-	7.8%
Law and taxation / Human Resources management	83%	89%	86%	32.3%	9.3%	26.4%
Management Control	No data available					
Learning activities outside the University	No data available					
Marketing and prediction techniques	No data available					
Fundamentals of graphical communication and mechanical production	-	-	98%	-	-	10.5%
Database and company information systems	-	-	96%	-	-	4.5%
Materials for technological applications	-	-	97%	-	-	0.01%
Quality management systems	-	-	93%	-	-	6.3%
Energetics and Ecology	98%	98%	98%	5.4%	5.4%	5.4%
Industrial plants and safety	-	-	98%	-	-	13.5%
Plant integrated management	-	-	98%	-	-	34.9%
Operations research	-	-	100%	-	-	37.9%
Average data	-	-	93%	-	-	13.83%

Table 3.1.4 Curriculum for Engineering and management in AY 2019/2020 (bachelor program)

Engineering and management						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Database	74%	79%	76.4%	6.5%	8.2%	7.3%
Industrial Energy Systems	84%	67%	73.4%	20.7%	5.3%	11.1%
Statistics	-	-	68%	-	-	4.6%
Economics and business organization	69%	69%	69.3%	3.1%	1.8%	2.3%
Industrial electric systems	84%	80%	82.1%	22.2%	14.8%	18.2%
Operations research	83%	89%	84.6%	32.3%	9.3%	26.4%
Production system	72%	79%	75.5%	10.8%	12.2%	11.5%
Industrial plants	-	-	84%	-	-	2.4%
Materials technology	92%	92%	92.2%	21.4%	4.5%	12.3%
Private law	-	-	89%	-	-	2%
Production scheduling and control	-	-	78%	-	-	0
Distribution logistics	-	-	69%	-	-	0.3%
Average data	-	-	78.5%	-	-	8.2%

Table 3.1.5 Curriculum for Chemical and food engineering in AY 2019/2020 (bachelor program)

Chemical and food engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Chemistry for food and chemical engineering	Data not available					
Engineering Drawing	-	-	38%	-	-	12.2%
Fundamentals of organic chemistry, molecular biology and microbiology	81%	81%	80.6%	7.1%	8.3%	7.7%
Thermodynamics for chemical engineering	-	-	60%	-	-	1.3%
physical-chemical separations	-	-	52%	-	-	1.6%
Control, instrumentation and safety for chemical processes	Data not available					
Transport phenomena and Chemical Reactors	59%	60%	59.3%	1.4%	1.8%	1.6%
Fluid machines	-	-	77%	-	-	5.7%
Structural Mechanics	Data not available					
Electrical circuits and Network Analysis	-	-	75%	-	-	12.9%
Facilities for chemical and food industry	-	-	82%	-	-	22.8%
Science and technology of materials	-	-	83%	-	-	16.9%
Industrial Chemistry	-	-	79%	-	-	19.8%
Average data	-	-	68.6%	-	-	10.3%

Table 3.1.6 Curriculum for Aerospace engineering in AY 2019/2020 (bachelor program)

Aerospace engineering										
Subject's name	**Exam pass rate**					**Full store rate**				
	Professor 1	**Professor 2**	**Professor 3**	**Professor 4**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Professor 4**	**Average full score rate**
Engineering Drawing	Data not available									
Fundamentals of Electrical and Electronics	63%	65%	63%	65%	64.2 %	0.2%	16.1 %	0.2%	16.1 %	7.3%
Applied thermodynamics and heat transfer	64%	65%	-	-	64.4 %	1.84 %	13.7 %	-	-	7.6%
Enterprise economics and management/Aeronautic law and human factors and safety	78%	80%	82%	-	80%	4.5%	4%	3.6%	-	4%
Fundamentals of structural mechanics	78%	78%	-	-	77.7 %	10.4 %	9.4%	-	-	9.9%
Mechanics of machines	52%	46%	-	-	48.7 %	10.5 %	10.5 %	-	-	10.5 %
Aerodynamics	80%	70%	-	-	75.1 %	7.6%	8.8%	-	-	8.2%
Aircraft constructions	71%	76%	-	-	73.9 %	5.6%	10.8 %	-	-	8.4%
Fundamentals of machinery and propulsion	78%	78%	-	-	77.8 %	10.4 %	9.4%	-	-	8%
Science and technology of materials/Metallurgy	65%	62%	64%	-	64.4 %	0.3%	3.2%	1.3%	-	1.3%

Aerospace on-board systems	85%	-	-	-	85%	3.4%	-	-	-	3.4%
Fundamentals of flight mechanics	75%	-	-	-	75%	5.9%	-	-	-	5.9%
Average data	71.5%					6.8%				

Table 3.1.7 Curriculum for Automotive engineering in AY 2019/2020 (bachelor program)

Automotive engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Engineering Drawing	81%	-	81%	1.6%	-	1.6%
Applied mechanics and machines	54%	-	54%	6%	-	6%
Applied thermodynamics and heat transfer	41%	-	41%	0.06%	-	0.06%
Fundamentals of electrical and electronic systems	61%	61%	61%	2.3%	2.3%	2.3%
Fundamentals of structural mechanics	52%	-	52%	2.5%	-	2.5%
Automatic control	Data not available					
Motor vehicle design	Data not available					
Manufacturing and assembly technologies	70%	-	70%	3%	-	3%
Fundamentals of machine design	Data not available					
Science and technology of materials/Technology of metallic materials	44%	44%	44.1%	0.05%	0.05%	0.05%
Thermal Machines	36%	-	36%	1.2%	-	1.2%
Average data	-	-	54.9%	-	-	2.1%

Table 3.1.8 Curriculum for Mechanical engineering in AY 2019/2020 (bachelor program)

Mechanical engineering														
Subject's name	**Exam pass rate**							**Full store rate**						
	Professor 1	**Professor 2**	**Professor 3**	**Professor 4**	**Professor 5**	**Professor 6**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Professor 4**	**Professor 5**	**Professor 6**	**Average full score rate**
Engineering Drawing	Data not available													
Applied mechanics and machines	58%	56 %	67%	-	-	-	60.2%	8.6 %	6.1%	6.6%	-	-	-	7.2%
Applied thermodynamics and heat transfer	42%	54 %	54%	-	-	-	44.6%	1%	5.9%	2.8%	-	-	-	2.8%
Experimental Statistics and Mechanical Measurement	58%	56 %	-	-	-	-	57.1%	5.6 %	7.4%	-	-	-	-	6.2%
Fundamentals of structural mechanics	66%	71 %	58%	-	-	-	59.7%	7.4 %	9.1%	4.1%	-	-	-	6.9%
Science and technology of materials/Technology of metallic materials	53%	49 %	52%	49%	51%	52%	51.1%	4%	0.5%	3.9%	0.5%	1.6%	1.6%	2.1%
Fluid Mechanics	77%	66 %	73%	-	-	-	71.6%	9%	6.7%	3.9%	-	-	-	6.5%
Fundamentals of machine construction	Data not available													
Introduction to electrical engineering/Electrical machines	70%	71 %	62%	70%	71%	61%	67.3%	10 %	14.5 %	7.8%	9.9%	14.5 %	7.9%	10.6%
Fundamentals of thermal and hydraulic machines and of fluid power	65%	54 %	43%	-	-	-	50.5%	1.6 %	0.7%	1.9%	-	-	-	1.3%

Industrial plants and safety	79%	84 %	79%	-	-	-	80.6%	1%	11.8 %	0.4%	-	-	-	4%
Manufacturing Technology	75%	67 %	62%	-	-	-	67.9%	13. 7%	2.4%	1.2%	-	-	-	5.6%
Average data	-	-	-	-	-	-	61.1%	-	-	-	-	-	-	5.32%

Table 3.1.9 Curriculum for Energy engineering in AY 2019/2020 (bachelor program)

Energy engineering										
Subject's name	**Exam pass rate**					**Full store rate**				
	Professor 1	**Professor 2**	**Professor 3**	**Professor 4**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Professor 4**	**Average full score rate**
Engineering Drawing	67%	58%	-	-	62.9%	3.9%	11.3%	-	-	7.4%
Mechanics of machine	42%	37%	-	-	39.6%	3%	1.7%	-	-	2.4%
Applied thermodynamics and heat transfer	43%	70%	-	-	55.1%	1.4%	6.4%	-	-	3.7%
Introduction to electrical engineering/Electrical machines	48%	57%	58%	48%	52.5%	1.3%	7.2%	7.3%	1.3%	4.1%
Thermo-fluid dynamics	37%	-	-	-	37%	1.2%	-	-	-	1.2%
Power plants and sustainability	95%	-	-	-	95%	27.7%	-	-	-	27.7%
Structural Mechanics	54%	30%	-	-	40.1%	7.9%	6.4%	-	-	7%
Computational laboratory for heat transfer and Fundamentals of machines	67%	71%	58%	-	65.7%	2.4%	1.2%	0	-	1.1%
Applied energy and renewable sources	88%	-	-	-	88%	6.6%	-	-	-	6.6%
Science and technology of materials	Data not available									
Building physics and HVAC systems	83%	85%	-	-	84.1%	12.5%	11.7%	-	-	12.1%
Elements of nuclear engineering	76%	-	-	-	76%	14.1%	-	-	-	14.1%
Average data	-	-	-	-	48.7%	-	-	-	-	5.6%

Table 3.1.10 Curriculum for Mathematics engineering in AY 2019/2020 (bachelor program)

Mathematics for engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Introduction to Algebra and Geometry	63%	-	63%	15.4%	-	15.4%
Programming and scientific computing	54%	-	54%	13.3%	-	13.3%
Analytical Mechanics	74%	-	74%	13.9%	-	13.9%
Mathematical methods for engineers	75%	-	75%	19%	-	19%
Differential and Computational Geometry	83%	-	83%	25.4%	-	25.4%
Equations of Mathematical Physics	68%	-	68%	1.6%	-	1.6%
Probability and statistics	56%	-	56%	4.7%	-	4.7%
Functional analysis/Partial differential equations	65%	65%	65%	3.7%	3.9%	3.8%
Discrete Mathematics	77%	-	77%	31%	-	31%
Numerical methods	56%	-	56%	0.6%	-	0.6%
Average data	-	-	67.1%	-	-	12.87%

Table 3.1.11 Curriculum for Material engineering in AY 2019/2020 (bachelor program)

Material Engineering										
Subject's name	**Exam pass rate**					**Full store rate**				
	Professor 1	**Professor 2**	**Professor 3**	**Professor 4**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Professor 4**	**Average full score rate**
Engineering Drawing	62%	-	-	-	62%	12.2%	-	-	-	12.2 %
Thermodynamics for materials engineering	71%	-	-	-	71%	4.3%	-	-	-	4.3%
Organic Chemistry, Transport Phenomena and Safety	61%	61%	-	-	61%	1.4%	1.4%	-	-	1.4%
Introduction to electrical engineering/Electrical machines	48%	57%	58%	48%	52.5 %	1.3%	7.2%	7.3%	1.3%	4.1%
Mechanics of machines	54%	-	-	-	54%	9.8%	-	-	-	9.8%
Science and technology of materials	68%	-	-	-	68%	8.2%	-	-	-	8.2%
Fundamentals of machines	67%	71%	58%	-	65.7 %	2.4%	1.2%	0	-	1.1%
Fundamentals of structural mechanics	55%	-	-	-	55%	5.6%	-	-	-	5.6%
Metallic Materials	82%	-	-	-	82%	12.7%	-	-	-	12.7 %
Polymeric Materials: Science and Technology	86%	-	-	-	86%	40.5%	-	-	-	40.5 %

Science and technology of ceramic materials	80%	-	-	-	80%	8.3%	-	-	-	8.3%
Structure of matter	66%	-	-	-	66%	35.3%	-	-	-	35.3 %
Average data	-	-	-	-	66.9 %	-	-	-	-	12%

Table 3.1.12 Curriculum for Electrical engineering in AY 2019/2020 (bachelor program)

Electrical engineering										
Subject's name	**Exam pass rate**					**Full store rate**				
	Professor 1	**Professor 2**	**Professor 3**	**Professor 4**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Professor 4**	**Average full score rate**
Engineering Drawing	67%	58%	-	-	62.9 %	3.9%	11.3%	-	-	7.4%
Fundamentals of structural mechanics	55%	-	-	-	55%	5.6%	-	-	-	5.6%
Science and technology of materials	83%	-	-	-	83%	16.9%	-	-	-	16.9 %
Applied thermodynamics and heat transfer	41%	-	-	-	41%	0.7%	-	-	-	0.7%
Complex analysis and introductory statistics	47%	-	-	-	47%	3.9%	-	-	-	3.9%
Electrical circuits and Network Analysis	68%	-	-	-	68%	15%	-	-	-	15%
Mechanics of machines	54%	-	-	-	54%	9.8%	-	-	-	9.8%
Electrical Measurement	82%	-	-	-	82%	4.8%	-	-	-	4.8%
Electrical machines	74%	-	-	-	74%	6.6%	-	-	-	6.6%

Fundamental of power electronics	77%	-	-	-	77%	2.2%	-	-	-	2.2%
Electrical Systems and safety	76%	-	-	-	76%	4.4%	-	-	-	4.4%
Fundamentals of electrical drives	53%	-	-	-	53%	1.1%	-	-	-	1.1%
Average data	-	-	-	-	64.4 %	-	-	-	-	6.5%

Table 3.1.13 Curriculum for Computer engineering in AY 2019/2020 (bachelor program)

Computer engineering				
Subject's name	**Exam pass rate**		**Full store rate**	
	Professor 1	**Average pass rate**	**Professor 1**	**Average full score rate**
Algorithms and Programming	45%	45%	4.1%	4.1%
Circuit Theory	63%	63%	1%	1%
Computer architecture	59%	59%	29.6%	29.6%
Introduction to databases	68%	68%	13.5%	13.5%
Mathematical methods	48%	48%	7.3%	7.3%
Object oriented programming	53%	53%	13.3%	13.3%
Computer networks	66%	66%	5.1%	5.1%
Electronic systems, technologies and measurements	54%	54%	6.3%	6.3%
Operating systems	58%	58%	7.6%	7.6%
Signal analysis and processing	55%	55%	8%	8%
Applied electronics	60%	60%	5%	5%
Automatic control	40%	40%	4.4%	4.4%
Average data	-	55.8%	-	8.8%

Table 3.1.14 Curriculum for Electronic and communications engineering in AY 2019/2020 (bachelor program)

Electronic and communications engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Circuit theory and applications	63%	-	63%	1%	-	1%
Electronic devices	47%	-	47%	4.3%	-	4.3%
Automatic control	40%	-	40%	4.4%	-	4.4%
Communication networks	47%	-	47%	6.4%	-	6.4%
Electronic Circuits	42%	-	42%	4.6%	-	4.6%
Mathematical methods	48%	-	48%	7.3%	-	7.3%
Algorithms and Programming	45%	-	45%	4.1%	-	4.1%
Applied electronics	67%	-	67%	2.4%	-	2.4%
Signals and systems	55%	-	55%	8%	-	8%
Digital transmission and communication networks	54%	47%	49.7%	5.6%	6.4%	6.1%
Electromagnetic waves and antennas	64%	-	64%	9.1%	-	9.1%
Average data	-	-	51.6%	-	-	5.2%

Table 3.1.15 Curriculum for Physical engineering in AY 2019/2020 (bachelor program)

Physical engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Electrical circuits and Network Analysis	77%	-	77%	10.4%	-	10.4%
Electronic devices	57%	-	57%	21.7%	-	21.7%
Advanced methods for physics and Quantum physics	45%	44%	44.3%	10.4%	10.1%	10.2%
Electronic circuits	59%	-	59%	8.2%	-	8.2%
Mathematical methods for engineers	75%	-	75%	19%	-	19%
Applied electromagnetics	73%	-	73%	8.7%	-	8.7%
Applied Electronics	87%	-	87%	13.9%	-	13.9%
Nuclear Physics with Biomedical applications	80%	-	80%	18%	-	18%
Solid state Physics	66%	-	66%	21.1%	-	21.1%
Physics and Materials for Advanced Technologies	76%	-	76%	2.2%	-	2.2%
Technologies for Nanoscience	69%	-	69%	25%	-	25%
Average data	-	-	69.4%	-	-	14.4%

Table 3.1.16 Curriculum for Biomedical engineering in AY 2019/2020 (bachelor program)

Biomedical engineering										
Subjects name	**Exam pass rate**					**Full store rate**				
	Professor 1	**Professor 2**	**Professor 3**	**Professor 4**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Professor 4**	**Average full score rate**
Electrical circuits and Network Analysis	79%	81%	-	-	80%	23.6 %	22.2 %	-	-	22.9 %
Engineering Drawing	76%	81%	-	-	78.4 %	3.4%	14.2 %	-	-	8.9%
Fundamentals of biology, anatomy and physiology	81%	-	-	-	81%	1.9%	-	-	-	1.9%
Electronics	61%	51%	-	-	55.2 %	3.1%	4.1%	-	-	3.7%
Fundamentals of structural mechanics	58%	63%	-	-	60.6 %	1.4%	0.8%	-	-	1.1%
Mechanics of machines	69%	57%	-	-	63.5 %	15.2 %	11.3 %	-	-	13.3 %
Signal analysis	67%	-	-	-	67%	8.3%	-	-	-	8.3%
Applied thermodynamics and heat transfer	63%	54%	-	-	58.8 %	2.6%	2.3%	-	-	2.4%
Biomedical Transport Phenomena/Biomechanics	77%	78%	74%	-	76.4 %	3.1%	2.8%	2.8%	-	3%
Biomedical instrumentation	68%	67%	-	-	67.1 %	2.4%	2.2%	-	-	2.3%
Active implantable devices/Medical images	75%	81%	75%	72%	82.5 %	14.3 %	18.4 %	12.9 %	10.9 %	13.7 %

Science and technology of materials	68%	66%	-	-	67.3 %	3.6%	0.4%	-	-	1.9%
Average data	-	-	-	-	69.8 %	-	-	-	-	7%

Table 3.1.17 Curriculum for Cinema and media engineering in AY 2019/2020 (bachelor program)

Cinema and media engineering								
Subject's name	**Exam pass rate**				**Full store rate**			
	Professor 1	**Professor 2**	**Professor 3**	**Average pass rate**	**Professor 1**	**Professor 2**	**Professor 3**	**Average full score rate**
Cinema and Video	95%	-	-	95%	46.3%	-	-	46.3%
Interactive Media	95%	-	-	95%	37.2%	-	-	37.2%
Digital Technologies	62%	-	-	62%	1.8%	-	-	1.8%
Object oriented programming	53%	-	-	53%	13.3%	-	-	13.3%
Marketing and Media economics	82%	-	-	82%	23.3%	-	-	23.3%
Mathematical methods for engineers	56%	42%	42%	46%	5.4%	6.7%	2.4%	4.6%
Signal analysis and processing	55%	-	-	55%	8%	-	-	8%
Signal theory and Signal processing	62%	-	-	62%	4.8%	-	-	4.8%
Computer networks	66%	-	-	66%	5.1%	-	-	5.1%
Web Applications and Databases	81%	-	-	81%	16.7%	-	-	16.7%
Computer graphics	67%	-	-	67%	4.4%	-	-	4.4%
Ethics and law of communications	86%	-	-	86%	16%	-	-	16%

Image and video processing	82%	-	-	82%	11.5%	-	-	11.5%
Transmedia	93%	-	-	93%	5.6%	-	-	5.6%
Average data	-	-	-	73.2%	-	-	-	14.2%

Table 3.1.18 Curriculum for Civil engineering in AY 2019/2020 (bachelor program)

Civil engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Drawing	81%	-	81%	2.2%	-	2.2%
Thermodynamics and Heat Transfer for Engineers	40%	51%	44.8%	1.1%	1.4%	1.2%
Geology/Safety and Civil Protection	70%	-	70%	6.6%	-	6.6%
Analytical Mechanics	55%	-	55%	7.4%	-	7.4%
Science and technology of materials	55%	73%	63.7%	6.3%	11.7%	8.8%
Topography	48%	47%	47.7%	22.6%	6.5%	13.1%
Hydraulics	58%	50%	52.9%	9.8%	5.4%	7.2%
Probability and statistics for engineering	56%	-	56%	6.5%	-	6.5%
Structural Mechanics	56%	-	56%	5.7%	-	5.7%
Geotechnics	42%	-	42%	2.6%	-	2.6%
Road infrastructures	53%	-	53%	4.3%	-	4.3%
Structural Engineering	33%	-	33%	4.2%	-	4.2%
Average data	-	-	54.6%	-	-	5.8%

Table 3.1.19 Curriculum for Environmental and land engineering in AY 2019/2020 (bachelor program)

Environmental and land engineering						
Subject's name	**Exam pass rate**			**Full store rate**		
	Professor 1	**Professor 2**	**Average pass rate**	**Professor 1**	**Professor 2**	**Average full score rate**
Applied thermodynamics and heat transfer	43%	70%	55.1%	1.4%	6.4%	3.7%
Drawing	81%	-	81%	2.2%	-	2.2%
Analytical Mechanics	55%	-	55%	7.4%	-	7.4%
Electrical Systems	52%	-	52%	0	-	0
Environmental chemistry/Applied ecology	69%	70%	69.2%	11.1%	11.3%	11.2%
Science and technology of materials	55%	73%	63.7%	6.3%	11.7%	8.8%
Topography	48%	47%	47.7%	22.6%	6.5%	13.1%
Environmental engineering	45%	-	45%	0	-	0
Hydraulics	58%	50%	52.9%	9.8%	5.4%	7.2%
Structural Mechanics	73%	-	73%	13.3%	-	13.3%
Applied Geology/Geophysics	66%	64%	64.9%	17.6%	17.6%	17.6%
Circular economy and environmental sustainability	94%	-	94%	24.1%	-	24.1%
Geotechnics	47%	-	47%	2.8%	-	2.8%
Average data	-	-	61.6%	-	-	8.6%

Table 3.1.20 Curriculum for Electronic engineering in AY 2019/2020 (bachelor program)

Electronic engineering		
Subject's name	**Exam pass rate**	**Full store rate**
Electrical circuits and Network Analysis	73%	12.3%
Electronic devices	47%	4.3%
Algorithms and Computers Architecture	47%	3.1%
Electronic Circuits	42%	4.6%
Mathematical methods for engineers	57%	7.1%
Applied Electronics	66%	5.9%
Electromagnetic Fields and Waves	64%	4.4%
Electromagnetic fields	81%	9.4%
Signal processing and communications	83%	14.4%
Automatic control	85%	41.6%
Electronic measurements	80%	45.8%
Measurement	79%	20.9%
Digital systems electronics	67%	12.2%
Average data	67%	14.3%