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Training orientation in female educational paths. The gender gap in STEM fields

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Abstract
Throughout the twentieth century education was, particularly in Western society, marked by the idea of gender differences, thereby conveying sexist stereotypes and outlining a culture that declared itself neutral. In reality this culture did nothing but "shape" the female gender based on the male prototype, which was considered to be superior. Differences in the skills of both sexes have, until today, been interpreted as consequences of "innate" inclinations, thus girls were directed towards certain activities and trajectories, while boys were directed towards others. Today we see a clear separation in the study directions, which has been defined by gender gaps: women opt for human and social sciences, while men prefer technical disciplines. The consequence of this, which is visible in many areas, is that women were considered "inadequate" to respond to the growing technological progress precisely because the culture they lived in had not prepared them to confront it. In particular, the obstacles felt by women in approaching the STEM area could be attributed to an "inner prohibition" of sorts, which is the result of an everlasting cultural legacy. Furthermore, school curricula are still directed towards gender conformation, thus leaving little space for individual differences, orienting males and females towards stereotypical choices, which do not always correspond to their own desires. On the other hand, female presence within the scientific and professional pathways of the STEM area, as well as their career advancement, are significantly lower than the one of males, as confirmed by the most recent Italian data as well as international literature, highlighting, even today, the persistence of an unfriendly approach to female presence in the digital world. The present study, which takes the form of a review of the current state of the art on the topics in question and is based on the epistemological paradigm of the critical feminist pedagogy, attempts to decode the implicit principles in the field of individual education. It also strives to demonstrate historical differences in knowledge transmission according to the traditional and patriarchal pattern of understanding female and male characteristics, thereby affecting the attitudes of men and women and influencing their educational choices.
Keywords: *STEM, gender gap, critical feminist pedagogy, education, orientation.*

1. Introduction

The gap between men and women in the workplace and academia, known as the gender gap, is now a widely known phenomenon, but not yet sufficiently explored.

The low female presence in the technical-scientific labor market has effects not only on a socio-cultural level, but also on an economic one, since part of the most qualified human capital is dispersed and with it a potential increase in productivity and in the consumption of products and services is lost.

Although Italian women graduating in STEM area disciplines are still less numerous than their male counterparts, it should be emphasized that these tend to have better university results both in terms of academic results and in terms of completion times. (Liccardo et al., 2010).

The gender gap in the academic and professional paths, therefore, in addition to perpetuating segregating logic, generates two kinds of problems: firstly, because it concerns professions that enjoy a high level of work, with salary levels often higher than the national average , which should prompt more women to specialize; secondly, because these sectors are the frontier of innovation, and therefore would benefit from a greater diversity of views and heterogeneity in the approach to the STEM disciplines. Furthermore, greater female participation in the STEM sectors would favor a more effective use of human resources, regardless of gender.

The slow, albeit gradual increase in the number of women in the STEM sectors represents a strong signal of policy effectiveness at European level. In fact, female participation in technological and digital progress is one of the objectives of the Europe 2020 Strategy and, more precisely, among the key points of the Horizon program (European Commission, 2010a).

Faced with the multiple advantages that women's expertise would bring to the well-being of society as a whole, on the one hand the resistances that comes from education are still strong, still based on stereotyped models, calibrated on socially deemed inclinations more suited to men or women; on the other hand, we find inner resistances to the

women themselves, who shy away or consider themselves unfit to undertake so-called "non-traditional" trajectories.[1]

This paper is part of this context of reference, and intends to provide a certainly not definitive representation of the universe underlying the relationship between women and the STEM area, both disciplinary and professional. Therefore, the first paragraph will outline a theoretical and political framework that is certainly not exhaustive of the subject in question; in the second paragraph will be provided a photograph of women who have chosen technical-scientific careers; in the third paragraph we will analyze the obstacles, sometimes invisible, that lie behind the scarce presence of women in the scientific training courses; the fourth paragraph presents new configurations of inequality and segregation at work level; finally, the fifth paragraph intends to propose possible gender equality itineraries in training orientations for girls and boys, presenting some good practices already implemented by different Italian cities.

2. Women and STEM: theoretical and policy framework

Rapid technological advancements and digitalisation are transforming the world of work and how we live our day-to-day lives. There is an increasing demand for digital skills and higher qualifications across a wide variety of sectors. Information and communications technology (ICT) specialists are in particularly high demand, with employment growth more than eight times higher than the average employment growth in the EU (Eurostat, 2017). Recent forecasts predict a shortage of more than 500 000 ICT specialists by 2020 (Korte et al., 2017). However, only around 17 % of the almost 8 million ICT specialists are women, and the number of women graduating from ICT studies has been decreasing over the last decade (EIGE, 2017a). The vast under-representation of women in ICT shows a waste of highly qualified human resources and has larger implications for the wider economy. In particular, it threatens the EU's innovative and economic potential in the future and contradicts the EU's highest political priority of smart, sustainable and inclusive growth. It is estimated by EIGE that attracting more women to

[1] Note that the two factors are closely related to each other, in a relationship of reciprocal causality, so if women perceive themselves as inadequate for certain disciplinary sectors, it is due to the influence of the cultural legacies that have long underpinned the education.

the STEM sector would lead to economic growth, with more jobs (up to 1.2 million by 2050) and increased gross domestic product over the long term (up to EUR 820 billion by 2050) (EIGE, 2017b).

From the point of view of European policy, the Europe 2020 strategy (European Commission, 2010b) is the EU's main strategic document for growth and jobs for the current decade. The strategy sets out the headline target of 75% employment for women and men aged 20-64. This implies reinforcing education and training for women, particularly in sectors where they are under-represented. The evidence of persistent skills shortages in the ICT sector in spite of high unemployment levels in many Member States shows that there is a vast pool of untapped potential, especially among women, as well as a waste of resources and a lack of investment in human capital.

A wide range of other EU policy initiatives, such as the digital agenda for Europe (2010), the Grand coalition for digital jobs (2014), the recently updated digital single market strategy and the new skills agenda for Europe (2016a) address the Commission's highest political priority, "a new boost for jobs, growth and investment". The shortage of ICT specialists and the vast under-representation of women in this fast growing sector are well documented. The new skills agenda for Europe acknowledges that tackling the skills deficit will require significant policy efforts and systemic reforms in education and training. It also seeks to ensure that people have the right skills throughout their lives, not only to improve their prospects in the labour market, but also to enable them to fulfil their potential as confident and active citizens (EIGE, 2018).

From what has been said so far, it can be seen that the phenomenon of female underrepresentation in scientific training courses is similar to the tip of an iceberg, in other words as part of a broader set of social inequalities that the various policy and governance systems must necessarily take into account (OECD, 2017). In fact, the question of the gender gap is at the center of work-family balance policies in many European Union countries.

As evidenced by the OECD data (2015a), countries with the highest shares of women working from home also have the highest maternal employment rates, while no such relationship emerges for men. Moreover, evidence from the United States shows that gender pay gaps

tend to be lower in industries where working arrangements are more flexible (Goldin, 2014).

In the labor market, a greater possibility of employment certainly depends on the possession of specific skills and, consequently, from having a high educational qualification (Arntz et al, 2016); from this point of view women are undoubtedly advantaged, being more educated than men (OECD, 2016a). However, they remain disadvantaged compared to those occupational areas that offer a wider career margin, such as the STEM area. In particular, in the OECD countries there is a percentage gap of 4 points between men and women employed in sectors that require specialized ICT skills (OECD, 2016b). Investing in women's education in this area therefore represents, especially in the Italian context, an educational emergency since 88.000 new jobs that will require ICT specializations will create between 2018 and 2020 (Assinform, 2018).

3. Women in non-traditional paths

The female presence in the study paths in the scientific area and in the professional sectors of the STEM area is generally lower than that of men; despite this, in recent years it has been constantly growing. It is a non-homogeneous but rather articulated, differentiated and moving presence. The women who today live professionally in the STEM fields tell us something about the transformations that took place over time in gender trajectories within training systems, in labor markets but also in social systems as a whole.

At European level, out of the total number of graduates in the 25-34 age group, STEM graduates represent, in fact, 23% with a trend that clearly shows, in the comparison between cohorts of different ages, how the new generations are progressively approaching these disciplinary fields. At the same time, female employment is also growing within these camps with women who now represent 43% of those employed in the STEM sectors (OECD, 2015b).

At the base of the female underrepresentation in the "non-traditional" paths, which also accounts for a certain resistance to the change of the phenomenon, there would be several reasons, including the problems that women encounter not so much in reference to obtaining the degree or

entering in the labor market, but rather to working conditions, the quality of working life and the possibility of career advancement. (De Vita, 2013 If on the one hand the low presence of women in these fields remains the reason for the persistence of the status quo of organizational practices, marked by the male, on the other hand the hierarchization of the same hinders women to reach top positions (Sala, 2003; Simonazzi, 2006).

The "challenge" represented by the choice of women to undertake countertrend paths, first of all engineering, is not accidental, but is motivated primarily by the fact that it is the sector, among the scientific ones, in which the imbalance between males and females is deeper. As well as from the fact that traditionally for the SET disciplines (science, engineering, technology), the conviction is still strongly rooted that these sectors are governed by exclusively meritocratic criteria, in which the evaluation based on the results and on the personal contribution to the growth of knowledge would exclude any gender bias (Etzkowitz, Kemelgor and Uzzi, 2001).

However, rather than inserting themselves in these fields because of a desire for emancipation as happened in the past (when traditionally the training paths of girls and boys were determined by gender stereotypes, so the girls were oriented towards care professions and boys towards technical and scientific disciplines), these women respond to new market demands by introducing new spaces of action in ways of doing science and building innovative knowledge territories. Moreover, the profile that emerged from a recent research (Bianchieri, 2010) shows that the new generation of engineering students is represented by motivated and determined girls who aim to acquire a solid wealth of knowledge and skills, in line with market demands. Not only that, women who move on border knowledge (for example physics and mathematics), would be bearers of a plural and interdisciplinary competence, differently from traditional scientific careers, above all male, that in the past built their expertise mostly within disciplinary fields with more marked boundaries (such as that of pure mathematics).

The trajectories in which women participate in science today are therefore characterized by the hybridization of knowledge and a continuous reconfiguration of research fields (De Vita and Viteritti, 2017). Furthermore, they are mobile and flexible trajectories (Elliot and Urry,

2010), suitable to adequately respond to the needs of conciliation, an issue that represents the main problem of employed women. Among the strategies used by women to overcome these career obstacles is the choice to prefer entrepreneurial paths, in order to manage the activities and times of their work independently. Also for this reason the women managers of the hi-tech sector are constantly increasing in Italy[2]. The issue of conciliation between work, family and personal life appears to be crucial from the point of view of professional advancement, in fact, segregation phenomena between the same workers, in particular between those who have families and singles, would be found. Some women entrepreneurs have declared that pregnancy constitutes a cost for organizations (De Vita, 2013), normalizing discriminatory dynamics and showing how masculine culture is somehow accepted by the women themselves.

4. The educational choices of girls: limits or opportunities?

The female predilection for training courses closer to the humanities and care disciplines is certainly not a novelty, it derives from a series of cultural conditioning, even before being of a socio-economic and family nature, in addition to the tendency to attribute to girls and boys innate predispositions towards certain attitudes (Ulivieri, 2001).

The 2012 PISA data show that a substantial percentage of italian households tend to direct their children towards educational pathways differentiated by gender. There is a tendency to consider twice as likely a future career in the field of science, technology, engineering and mathematics for male children rather than for daughters, even when the children of both sexes demonstrate identical skills both in mathematics and in other scientific subjects. These choices do not seem to be based on the school performance of young people: on the contrary, italian boys tend to have less brilliant school performances than those of their female peers (OCSE, 2012; OECD, 2015c).

Every age has associated the difference between the sexes with defined communication and behavioral codes, developing real role models for males and females that reproduce through religion, language and, above

[2] On the national territory there are 1,287 *hi-tech* companies led by women, Chamber of Commerce data, Milan, 2015.

all, education in the family and in society (Seveso, 2001). These models are transmitted from one generation to another, and training, understood as a process of development, socialization, inculturation, is the main device.

It is no coincidence that the educational practices were in Western culture and, in particular, in the Italian culture, very differentiated on the basis of sex: more or less openly and with different degrees of discrimination. For centuries girls and young women have been the object of a calibrated "pedagogy of ignorance" which exalted in them an alleged emotional, irrational, sensitive, pragmatic nature, lacking in capacity for synthesis and abstraction, proper instead of the male sex (Ulivieri, 1992).

Recent studies (Rebollo-Catalán, Vico-Bosch, and García-Pérez, 2015) have analyzed women's learning skills in relation to information and communication technologies, revealing innovative aspects in information acquisition processes. In fact, women would learn more through informal contexts, turning more to friends, family or virtual resources to learn more about ICT. The research also demonstrates that women use multiple autonomous learning strategies based on experimentation with technology, rather than using collaborative learning strategies through participation in groups, associations or projects. Still, other studies (Sánchez-Vadillo, Ortega-Esteban and Vall-llovera, 2012) have analyzed the factors that influence digital skills from a gender perspective. The authors indicate that, in ICT learning, the influence is drawn from the nearest models and references (family and school), from the media and from the expectations of the girls. They also affirm that gender stereotypes can contribute to women's disaffection with the technological universe, leading to a lack of motivation towards their professional capacity, as well as personal aspirations. The modeling function of the media through the tool of gender stereotypes has also been examined by Marone and Striano (2012) and recognized as a producer of an inequality which in turn generates submissions and social hierarchies. In fact, the alleged female subordination passes through the language and the imagery conveyed by the mass media.

In summary, the studies that focused on how women learn through the use of new technologies have shown that they resort to a multiplicity of learning strategies, such as autonomous or collaborative styles; despite this, they prefer to devote themselves independently for the pleasure of

intuitively experimenting with technologies and above all learning new strategies (Vergés et al., 2011; García-González et al., 2012; Gros, 2015). These evidences, on the basis of cyber feminist approaches (Haraway, 1995; Plant, 1998), arise in contrast with the traditional gender stereotypes that would assume the existence of a sort of technophobia on the part of the female subject. This peculiar self-directed educational process characteristic of women, which is expressed in the preference for autonomous learning of ICT strategies, represents a crucial factor of promotion for digital inclusion, as well as an important element to be taken into account when thinking about programming of university training courses (Jiménez-Cortés et al., 2017).

Although the women who undertake the profession of engineer are increasing, this profile is set in the masculine by definition. The very figure of this professional coincided with the masculine in European society. The engineer, as a male, was entitled to manipulate all the opportunities for acquiring knowledge to play his role as a rationalizer in modernization and industrialization. The feminization of the profession began only within the cultural élites of the late Nineteenth Century, through a difficult and slow inclusion process, in which women still struggle to find spaces for legitimacy (Giannini and Scotti, 2007). The stereotypes linked to the scarce abilities of women in science are associated with the very low familiarity attributed to women in technical matters. Numerous studies have clarified on the one hand the influence of primary socialization processes which, starting from the family to continue with the school, support some models of behavior considered appropriate with respect to gender, (Gianini Belotti, 1973; Marone, 2003), on the other the lack of a real foundation about the alleged inferiority (traced back to a "natural" inferiority) of women in scientific subjects and, therefore, in the "things of men". (Butler, 1990). What seems to exist is instead a strong conditioning deriving from the presence of these discriminations, the "threat of the stereotype" (Nguyen and Ryan, 2008), which would influence the girls to push them to give up the comparison with peers in science subjects. These conditionings, which find their deep roots in the last century, have been the center of the work of deconstruction carried out by the feminist critical pedagogy towards conventional theories on education (Marone, 2002). This approach aims to promote the reflexivity of the trainees to acquire a new critical awareness

of the basic assumptions that, internalized by each as part of culture, regulate social relations.

5. New metaphors of inequality

The category of gender has always been a factor of inequality, used as a tool of power in defining social, political and economic dynamics. The perspective of critical feminist pedagogy has engaged itself precisely in decoding those assumptions that have historically relegated women to a position of subordination with respect to man in the field of knowledge, as well as with respect to the role played in society and in the profession.

In the workplace, concepts such as "vertical/horizontal segregation" are known alongside those of *glass ceiling* to describe the forms of exclusion of women from career advancement and achievement of top positions. Other concepts, reminiscent of Darwinian logic, refer to "tournament theory" (Luciano, 1993), according to which those who have not been selected as potential winning resources will continue to remain outside any further investment. It is an extremely complex and multifaceted phenomenon that in recent acquisitions tends to overcome the metaphor of the aforementioned glass ceiling or sticky floor, to take on broader expressions such as that proposed by Aker (2009) of "inequality regimes" or the "labyrinth of leadership" (Eagly and Carli, 2007). The perplexities derive mainly from the fact that the metaphor of the glass ceiling takes on the one hand the existence of an absolutely impenetrable barrier, while many women have broken it, on the other it implies an orderly progression upwards, abruptly blocked by an invisible barrier only shortly before reaching the finish line. In short, the fact that career obstacles are distributed in every direction and along the entire career path would be underestimated, starting as early as the first entry into the market (Meyerson and Fletcher, 2000).

There are many women who have laboriously conquered positions that it would be legitimate to reach without any effort (or more than men), yet precisely because of the need to defend what has been achieved and to continually demonstrate their skills, these end up taking on professional attitudes marked by aggressiveness, competitiveness, considered typically male (Sala, 2003). It is therefore clear that one's job and professional

position (especially if this involves high responsibilities) must still be constantly negotiated and legitimized, in spite of the goals achieved compared to the past.

Gender inequality in the workplace is also found through the gender pay gap, whose causes include the low rate of labor participation, the level of segregation (for which a concentration of female participation is observed in certain sectors, basically those less remunerative than those with high male participation) and the dynamics of the labor market (the possibility of providing smart working or part-time contracts) (European Commission, 2016b). Therefore, if the gender gap exists regardless of all professional sectors, in the STEM one it is even more dense, particularly in Italy, probably due to the structure of the labor market and the low rate of female labor force participation (European Commission, 2015a).

6. Training orientation and gender equality

The development of a Country and its success in the global economy can only be achieved by favoring the development of the potential of all its citizens without any gender distinction. In this perspective it is essential to train future generations with knowledge and skills thanks to which they are able to analyze, evaluate and reformulate information and solve complex problems. The role of women in this scenario is as crucial as gender equality understood as the engine of development and well-being of each Country. Therefore, the overcoming of every gender stereotype becomes the main objective of every formative process, since, as has already been said in the present article, the main obstacle that arises between the female contribution and the scientific community in the STEM field is the alleged poor attitude of female students towards these disciplines, which has led to a gender gap in these disciplinary sectors, both within the study pathways and in educational and professional orientation choices. Women, who for a long time constitute more than half of the graduates in Italy (in the academic year 1991/92, for the first time in Italy, matriculated women have surpassed men), represent among the graduates of 2017 59,2% of the total. In the Italian training system there is a strong differentiation in the gender composition of the various disciplinary areas. In the first level courses women make up the

strong majority in the teaching groups (93.9%), linguistic (84.2%), psychological (81.5%) and health professions (70.1%). Conversely, they are a minority in the engineering groups (26.0%), scientific (31.7%) and physical education (34.2%). This distribution is also confirmed within the two-year magistral courses. The majority of women, in fact, tend to attend courses on chemical-naturalistic subjects, to the detriment of computer-engineering subjects, in which these are clearly underrepresented within the individual disciplinary groups (Graph 1) (AlmaLaurea, 2018)[3].

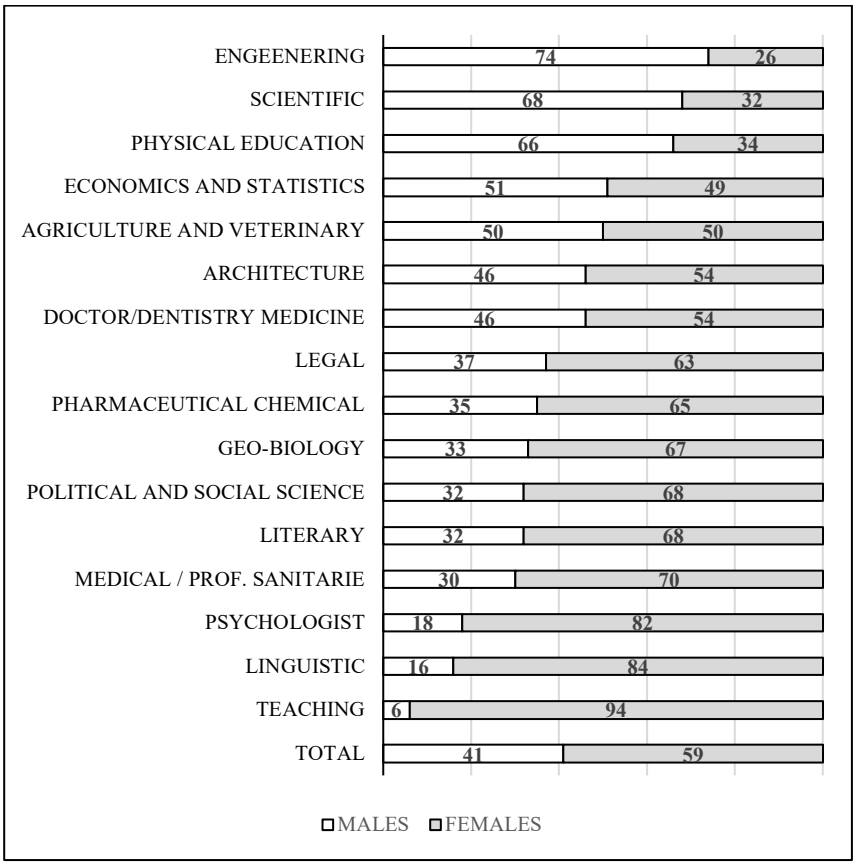
Similar evidence with respect to gender differentiation of disciplinary groups has also been reported by American research (Mann, Jegewie, DiPrete, 2015), in which the role of primary and secondary education was analyzed in the genesis of gender differences in the development of the propensity to choose a STEM career by women. The study found that, for both boys and girls, a stimulating and competitive school environment is an important factor for the development of a propensity to deepen the study of scientific subjects, a factor that in turn significantly conditions the choice of university courses and careers related to the STEM world, especially if young people are exposed to feedback that highlights their skills in this area. Despite the presence of a competitive environment brings benefits both genders, the research highlights how this competition widens the gender gap related to the mathematical-physical subjects in favor of children and related to the geo-biological subjects in favor of girls. This figure would explain the reason why women with a university degree are almost twice the number of men both in the scientific and geo-biological disciplinary area, while men are double the number of female colleagues in the scientific area and in the area engineering, as evidenced by the AlmaLaurea data.

The University of Naples "Federico II" guarantees gender equality and equal opportunities, for this reason, in 2016 the Gender Report was published, one of the few carried out by research centers and universities Italian. The document presents a systematic description of the male and female distribution within the study paths: student population matriculated

[3] The low representation of women in engineering and scientific study courses also has an impact on employment outcomes, in fact women have a lower propensity to choose jobs related to the world of information systems, as shown by the data reported in the online document "Italian women and STEM careers". http://www.minervaonline.org/wp-content/uploads/2016/11/DONNE-E-CARRIERE-STEM.pdf

(10475 women and 9041 men), registered (46884 women and 36726 men) and graduate (female percentage of 58% of the total); post-graduate education (55% of women in the doctorate, 59% in masters).

GRAPH 1. GRADUATES BY GENDER AND DISCIPLINARY GROUP



Source: AlmaLaurea, *XX Indagine Profilo dei Laureati 2017. Rapporto 2018.*

Furthermore, the Report gives a picture of the university composition in which the gender gap still seems to be unresolved. The data highlighted by the Gender Report of University of Naples seems to resume the European ones (European Commission, 2009), in fact there is an increase in the number of women attending university courses up to the doctorate, but top positions in the academy, together with some fields of knowledge, still remain dominated by men. Similarly, the "She figures"

report (European Commission, 2009) shows that women are less numerous in science than male colleagues since the beginning of the training course; the percentage composition between the two genders remains rather stable up to the role of researcher and then gives rise to a substantial divarication of careers in the academic field, with a very low female presence in the most prestigious academic positions. In addition, the academic performances of Italian women are better than those of men, with the same educational background. In general, women graduating in scientific faculties are less numerous than male colleagues, but on average more skilled (they tend to graduate with higher grades than men) (AlmaLaurea, 2018). Immediately after graduation, however, the gap is reversed: only 59.2% of newly graduated women work against 64.8% for men (Istat, 2017). These data provide very clear indications of the existence of cultural and structural obstacles which determine, on the one hand, the abandonment of scientific careers by women and, on the other, the persistence within the institutions of a strong horizontal and vertical segregation, with some areas and positions of prevalence of a single gender.

Although literature and statistics tell us that school results are equal and sometimes exceed those of male students, female students tend to have less self-esteem than boys in STEM disciplines, that is, on average, less confidence in their "scientific" abilities compared to their male counterparts.

It is therefore necessary to invest in education from childhood, allowing children and girls to approach the world of science, technology, mathematics and engineering without sense of fear, inadequacy or anxiety trying to eliminate the gender gap. To pursue this goal, it is certainly important to change the training approach towards STEM subjects, using innovative, active and informal learning models as was done in 2017 by an Italian comprehensive institute (Brindisi, Puglia), thanks to a call of the Department of Equal Opportunities. The project was attended by 33 students, 8 of whom were male and 25 were female, belonging to the last year of primary school and to the first grades of lower secondary school. The methodology used was that of *tinkering*, based on the *think-make-improve* cycle.

This methodology increases the awareness that "by studying, trying and making a mistake we arrive at the desired result". The mistake is not seen negatively, but as an opportunity to progress and improve learning, instilling in the students' satisfaction and self-confidence. By playing and exploring, problems are approached through a process in which learners "dirty their hands", operating on objects (material or virtual) that are perceived as real and for the resolution of which the student feels intrinsically motivated. Precisely these motivational aspects, as mentioned in the introduction, are often the preliminary elements that invalidate the relationship between the STEM disciplines and the female world. The experience has led to positive and satisfactory results from the point of view of the motivation of girls and boys, but also a very good and positive atmosphere, perceived above all by parents.

Among the smartest Italian cities there are Milan, Florence and Bologna (Tab. 2). Milan, leader in the top ten of the annual ICity Rate report (FPA, 2018), is the promoter of numerous initiatives dedicated to overcoming the gender gap in the STEM field. Among the objectives pursued, Milan intends to promote t the dissemination of technical-scientific disciplines and new digital technologies as opportunities for the professional future of the new generations. It does this through the organization of events, seminars, training courses, meetings, debates, role modeling sessions and shows, as well as including proposals for nursery schools, primary schools, secondary schools of first and second grade, up to the Universities.

According to the considerations set out in this contribution, it is clear that the success of the training paths constitutes one of the fundamental elements for the growth of a Country and for the success of future generations; therefore it becomes of primary importance to rethink good educational practices from the first grades of education, to carry out projects that encourage female students towards a profession tailored to their own interests and talents, even in those paths that have long been the prerogative of competences and predispositions held prevalently male; a formation free from gender conditioning.

TABLE 2. GENERAL RANKING OF THE 107 SMARTEST ITALIAN CITIES

6R.	*CITIES*	*POINTS*	*R.*	*CITIES*	*POINTS*	*R.*	*CITIES*	*POINTS*	*R.*	*CITIES*	*POINTS*
1	MILANO	640,2	**28**	BIELLA	492,7	**55**	TERNI	434,9	**82**	SASSARI	334,7
2	FIRENZE	621,6	**29**	SIENA	492,6	**56**	CUNEO	434,5	**83**	ISERNIA	331,7
3	BOLOGNA	620,0	**30**	RIMINI	491,9	**57**	VERBANIA	427,7	**84**	NUORO	328,9
4	TRENTO	583,6	**31**	BRESCIA	489,5	**58**	LUCCA	426,5	**85**	CAMPOBASSO	324,9
5	BERGAMO	567,1	**32**	LODI	488,0	**59**	ASCOLI P,	425,2	**86**	SIRACUSA	323,2
6	TORINO	547,7	**33**	FERRARA	485,2	**60**	L'AQUILA	423,9	**87**	LATINA	322,9
7	VENEZIA	544,1	**34**	LECCO	482,8	**61**	ASTI	417,4	**88**	PALERMO	322,1
8	PARMA	539,1	**35**	PAVIA	480,2	**62**	LECCE	408,9	**89**	CATANIA	312,9
9	PISA	538,6	**36**	BELLUNO	476,8	**63**	PESCARA	407,9	**90**	COSENZA	307,0
10	REGGIO E.	532,8	**37**	NOVARA	476,3	**64**	FERMO	405,7	**91**	ANDRIA	302,7
11	PADOVA	532,5	**38**	PERUGIA	470,8	**65**	MASSA	402,7	**92**	MESSINA	302,5
12	RAVENNA	531,7	**39**	COMO	469,6	**66**	ALESSANDRIA	402,1	**93**	FOGGIA	298,2
13	PORDENONE	529,9	**40**	AOSTA	468,3	**67**	BARI	391,6	**94**	CATANZARO	296,9
14	TRIESTE	523,2	**41**	PIACENZA	467,9	**68**	PISTOIA	390,3	**95**	AVELLINO	296,7
15	ROMA	522,7	**42**	AREZZO	465,2	**69**	GROSSETO	385,1	**96**	RAGUSA	296,2
16	CREMONA	522,6	**43**	CAGLIARI	459,1	**70**	MATERA	384,9	**97**	REGGIO CAL.	292,5
17	MODENA	521,0	**44**	MACERATA	458,1	**71**	FROSINONE	381,0	**98**	BENEVENTO	287,6
18	UDINE	520,6	**45**	ANCONA	457,0	**72**	RIETI	369,5	**99**	CASERTA	283,0
19	MANTOVA	516,0	**46**	VARESE	455,1	**73**	POTENZA	362,9	**100**	BRINDISI	278,3
20	BOLZANO	512,9	**47**	SONDRIO	455,1	**74**	VITERBO	360,8	**101**	ENNA	275,1
21	TREVISO	512,1	**48**	PRATO	454,7	**75**	IMPERIA	357,6	**102**	TARANTO	268,9
22	VERONA	506,7	**49**	VERCELLI	449,6	**76**	TERAMO	354,8	**103**	CROTONE	248,8
23	GENOVA	503,5	**50**	GORIZIA	446,8	**77**	ROVIGO	351,0	**104**	TRAPANI	237,4
24	FORLÌ	500,6	**51**	PESARO	439,8	**78**	ORISTANO	350,2	**105**	CALTANISSETTA	235,9
25	MONZA	496,6	**52**	LIVORNO	438,5	**79**	NAPOLI	345,3	**106**	VIBO VAL.	227,6
26	VICENZA	494,5	**53**	LA SPEZIA	435,7	**80**	SALERNO	342,9	**107**	AGRIGENTO	225,2
27	CESENA	493,7	**54**	SAVONA	435,6	**81**	CHIETI	336,6			

Source: Fpa, Rapporto annuale ICity Rate 2018.

In summary, we can affirm that although the number of women enrolled and graduated in the technical-scientific disciplines is progressively increasing over time, together with a more genuine interest in these disciplines, the stereotypes and prejudices are still resistant in both

training and work, as well as the cultural heritage behind the under-representation of women in these areas, and which played a significant role in influencing women's attitudes towards science and technology. The school curricula, through specific educational offers, stages and job orientation paths begin to show a new attention towards an education that is not a harbinger of new forms of gender discrimination; however, the trend of girls approaching the *hi-tech* world remains constant and in any case lower than that of boys (AlmaLaurea, 2018). We must therefore ask ourselves what this resistance to change must be traced.

If education represents the pivotal point for the progress of a Country, it is absolutely essential that a sector historically and "traditionally" dominated by the male gender be enriched and supplemented by the female contribution. For this reason, the objective of reducing cultural (in the belief system and in the consciences of each) and materials (within the organizational and institutional systems) distances between women and the technological universe becomes an educational urgency, achievable first of all through a critical attitude and the questioning of the existing order (Marone, 2002).

On the other hand, according to the evidence from the literature, we can say that, despite the achievements and goals achieved by women in the field of gender equality since the dawn of feminist struggles, this equality seems to emerge even today on a merely nominal rather than substantial level, as shown by the differences in economic treatments, in the forms of vertical and horizontal segregation, and in the difficult conjugation of working and family commitments.

A recent study by the European Commission (2013) has shown that greater female participation in professions related to the digital economy would lead to an increase in EU GDP of around 9 billion euros per year. Given the significant added value inherent in female participation in the STEM sectors, one would expect a greater push from the countries of the European Union to favor this rebalancing. Italy, in particular, which is experiencing a prolonged period of low economic growth and labor productivity, could aspire to progressively overcome the gender gap as a driving force for relaunching the economy and to focus more on high-tech sectors.

In conclusion, some possible positive actions that could be taken to fill the existing gender gap are: promoting female participation in STEM by removing gender bias in curricula and parental attitudes, raising students' awareness about the likely consequences of choosing different fields of study, and facilitating women's access to STEM-related jobs through apprenticeships. Furthermore, the influence that role models, networks and popular culture exert on gender attitudes and stereotypes cannot be excluded. Moreover, another objective is to close gender gaps in access to, and in the use of, new technologies; in fact, about 60% of the world population, in particular women in low- and middle-income countries, still have no access to the internet (ITU, 2017). Still, in order to guarantee equal opportunities between women and men, flexible ways of working using new technologies should be promoted; in particular, governments can help by granting all employees a right to request flexible working time arrangements; encouraging social partners to cover flexible workplace practices in collective bargaining agreements; and helping companies change their work organisation through the exchange of best practice and information campaigns promoting a change in the workplace culture (OECD, 2016c).

Last but not least, it is of crucial importance to adapt social protection systems to the new forms of work: non-standard workers, and thus many women, are unlikely to benefit from the same advantages as those on standard work contracts (European Commission, 2015b).

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Trening orijentacija u obrazovnim putanjama žena. Rodne razlike u STEM području

Sažetak
Tijekom dvadesetog stoljeća, osobito u zapadnom društvu, obrazovanje je bilo prožeto idejom rodnih razlika, prenosivši seksističke stereotipe i ocrtavajući kulturu koja se proglasila neutralnom, ali koja u stvarnosti nije ništa drugo nego "oblikovala" ženski rod na temelju muškog prototipa, koji je smatran superiornim. Razlike u vještinama oba spola interpretirane su kao posljedice "urođenih" sklonosti, stoga su djevojke bile usmjeravane prema jednim aktivnostima i putanjama, a dječaci prema drugima; sve do današnjeg dana, kada vidimo jasno razdvajanje u smjeru studiranja koje je definirano *rodnim razlikama*: žene se odlučuju za humanističke i društvene znanosti, dok muškarci preferiraju tehničke znanosti. Posljedica toga, vidljiva u mnogim područjima, jest da su žene smatrane "neadekvatne" odgovoriti na napredak tehnološkog napretka upravo zato što ih kultura u kojoj žive nije pripremila da se s njime suoče. Posebice, prepreke koje žene osjećaju u pristupu STEM (znanosti, tehnologiji, inženjerstvu i matematici) području mogu se pripisani nekoj vrsti "interne zabrane", koja je rezultat stalno prisutnog kulturnog nasljeđa. Nadalje, školski kurikulumi su i dalje usmjereni na rodnu konformaciju, ostavljajući malo prostora za individualne razlike, usmjeravajući muškarce i žene prema stereotipnim izborima koji uvijek ne odgovaraju njihovim osobnim željama. S druge strane, prisutnost žena na znanstvenim i stručnim putovima STEM područja, kao i napredovanje u karijeri, značajno je manja nego muškaraca, što potvrđuju i najnoviji talijanski podaci, kao i međunarodna literatura, naglašavajući, čak i danas, postojanje neprijateljskog stava prema pristupu žena digitalnom svijetu. Ovaj tekst, u obliku pregleda trenutnog stanja, oslonjen na epistemološku paradigmu kritičke feminističke pedagogije, nastoji dekodirati implicitne postavke u području individualnog obrazovanja i prikazuje povijesne razlike u prijenosu znanja prema tradicionalnom / patrijarhalnom obrascu shvaćanja ženskih i muških karakteristika, a koje utječu na stavove muškaraca i žena te na njihove izbore obrazovnih putanja.

Ključna riječ: *STEM, rodne razlike, kritička feministička pedagogija, obrazovanje, orijentacija*