



Meta-analysis of gender and science research

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1. Introduction

Even though the gender focus gained relevance already in the 1970s, the feminist literature started to bloom in Spain only after the political transition. For this reason during the next decades the interest was to introduce and discuss the main international theoretical contributions about the epistemology of science and the gender perspective. This generated abundant bibliography and a solid theoretical research line.

In parallel, there has been a development of descriptive studies about gender segregation in academia. The proportion of women among university students has been more than 50% since the early 1980s, but horizontal and vertical segregation remains relevant. A large part of the research effort was concentrated in this field due to the lack of sex-disaggregated data.

University courses, subjects and seminars about gender issues from a multidisciplinary perspective started to proliferate only in the 1990s though. Equality Observatories have been created recently at the universities in order to carry out studies about gender equality and develop action plans.

In 2005 the Unit of Women and Science (UMYC) of the Ministry of Education was created with the objective to develop positive measures that promote gender equality in science. The first plans of equality of women in science are being implemented now.

2. Analysis by topics

2.1. Horizontal and vertical segregation

Research questions

It is one of the main areas of research in Spain. Essentially two issues have been considered:

- The analysis of horizontal gender segregation in educational and professional fields, with a particular emphasis on the lack of interest that women have towards technology and technological careers.
- The analysis of the gender composition of staff in institutions dedicated to scientific work (universities, public research institutes, science academies), paying special attention to vertical segregation and the glass ceiling.

Research in this area mainly focuses on description, showing the under-representation of women in certain scientific areas and senior positions. Nevertheless, the studies that analyze horizontal segregation in the field of education adopt a more analytical approach which focuses on the analysis of the mechanisms of reproduction of the gender stereotypes throughout infancy and adolescence and their impact on the choice of an educational path.

Research approaches

Women account for more than 50% of university students since the beginning of the 1980s, but the low presence of women in technical studies remains. It is for this reason that there have been numerous studies about the attitudes of young people towards technology and the role school plays in the reproduction of gender stereotypes. They are mainly qualitative studies, based on interviews and observation, although studies based on surveys of young people and teaching staff have also been carried out.

Interest in the low presence of women in scientific careers is more recent and started to gain importance after 2000. Since then, a large number of detailed studies have been carried out in various institutions:

- The CSIC (Centro Superior de Investigaciones Científicas; Spanish National Research Council), the most important public research institution in Spain: in the early 2000s the Commission of Women and Science of the CSIC was created, promoting several studies about horizontal and vertical segregation in different CSIC institutes and fields of science (e.g. García and Goya, 2002; Ruiz, 2002) and regular monitoring reports about the whole institution.
- Public universities: In 2005 the first Equality Observatory in a university was created (Izquierdo et al., 2004). Since then several other public universities have created similar observatories initiating studies about the presence of women at different academic levels and recommendations about specific actions.
- The Royal Academies of Science (Reales Academias): The academies are the most prestigious institutions in the scientific system in Spain. A large part of these were created in the 18th century but the appointment of the first female academic took place in 1987. The Institute of Women (Instituto de la Mujer) has driven the analysis of the low presence of women and the mechanisms of gender discrimination in these institutions (García de León, 2005).
- Professional associations: The low female presence has also been analyzed in various professional associations, especially in the field of medicine – Sociedad Española de Epidemiología (Spanish Society of Epidemiology) and Sociedad Española de Salud Pública y Administración Sanitaria (Spanish Society of Public Welfare and Health Administration) (Ortiz et al., 2004).

Research in this field has been actively disseminated by the FECYT (Fundación Española de Ciencia y Tecnología; Spanish Foundation of Science and Technology) through comprehensive state-of-the-art reports on the situation of women in science (Alcalá et al., 2005 and 2007).

The main focus is placed on the compilation of data about the gender composition of these institutions, which is, at times, accompanied by some kind of survey to gather opinions and perceptions of scientists about gender discrimination. In some cases, the studies are based on a qualitative approach (mainly interviews). To prove the existence of discriminatory mechanisms in the way of the most prestigious positions (glass ceiling), some studies compare the levels of scientific productivity of men and women by field of science and professional level.

Findings

Considering the most recent data, the situation in Spain in relation to horizontal and vertical segregation in science can be summarized as follows (Alcalá et al., 2007):

- Over the last 30 years a strong increase in the presence of women has taken place amongst university graduates. Women account for more than half of university graduates since the beginning of the 1980s and since then their presence has continued to grow.
- Horizontal segregation has been reduced in some areas (experimental sciences), but it persists in engineering studies. This segregation is developed at an early age when students choose their educative path in secondary school.
- After completing their degree studies, a smaller proportion of women than of men orientate themselves towards research. This is especially true for particularly feminized studies. Although there has been a significant increase in the presence of women among people who have been awarded a PhD degree, equality has still not been reached.
- Vertical segregation in academic careers continues to be very prominent. The number of women in teaching and research positions is growing very slowly and fails to correspond to the rapid increase in the levels of female graduates and PhDs.
- There is no difference in the scientific productivity of men and women at the same professional level; therefore any kind of hierarchical discrimination is unjustified in a system that is meant to be meritocratic.

Some of these studies deal with issues related to other topics (identity and stereotypes, scientific excellence). The summary of their results is developed in the corresponding topics.

Gaps

The analysis is hindered by a shortage of statistical information, in particular:

- The lack of sex-disaggregated historical series about university graduates, academic staff and researchers.
- The absence of regular, official surveys of university graduates and doctors.
- The complete lack of panel surveys which make longitudinal analysis possible.

The analysis centres on academia. There are no studies about research in the private sector, with the exception of medicine.

There are no longitudinal studies about gender and scientific careers.

A large part of the research effort is aimed at the compilation of data. Analytical research, as will be shown in the subsequent topics, is still scarce and fragmented. The same occurs with the development of the gender indicators.

2.2. Pay and funding

Research questions

This line of research has scarcely been developed in Spain. Two questions are dealt with:

- The analysis of the wage discrimination in universities.
- The analysis of the unequal access to public grants and other R&D resources

Research approaches

The studies that analyze wage discrimination empirically are practically non-existent. Only one study has been identified: it was published in 1984 and deals with gender wage discrimination at the University of Valencia (Moltó, 1984). The objective of this study is to quantify the gap between men's and women's salaries which cannot be explained by noticeable differences and can only be attributed to gender discrimination.

The analysis of the unequal access to public research funding has been almost completely absent from research until very recently. However, it is an issue that is currently attracting increasing interest, although most of the efforts are addressed to gather sex-disaggregated information rather than undertaking more complex analysis.

Findings

The study about the University of Valencia (Moltó, 1984) found that 25% of the gender pay gap is due to gender discrimination, i.e. cannot be explained by noticeable differences in individual personal and productivity traits.

The studies about the access to research funding public grants and R&D resources show that women tend to have a lower rate of success than men (ratio between the number of successful applicants and the number of applicants). De Pablo (2006) made the first sex-disaggregated analysis of grant awarding of one of the most prestigious Spanish R&D post-doc programmes (Ramon y Cajal) in the mid 2000s, finding that the female rate of success was notably lower than the male rate for most of the scientific specialities. Castaño et al. (2008) arrive at a similar conclusion, analysing the distribution of the overall Spanish R&D resources in the same period: the women's rate of success for public grants was 20% (as compared to 23% for men) and 11% for R&D contracts (18% for men). González (2009) compares pre-doc and post-doc grants, concluding that women are clearly at disadvantage in post-doc grants, although in some traditionally masculine fields, like physics and engineering, it seems that efforts are made for promoting women.

Gaps

It is a topic of research which has barely begun. There are no recent empirical studies about gender pay gap and gender discrimination. Furthermore, the analysis of inequality in the access to funding is only starting and is mainly focused on collecting the most basic information.

2.3. Stereotypes and identity

Research questions

It is one of the topics that have generated the most interest and the most publications. Two issues are dealt with from a multidisciplinary approach:

- The social construction of science. From this perspective, science is analysed as a social construction and in terms of power. In this way, the neutrality of science is questioned and discriminatory biases, related to the subordination from 'the feminine' to 'the masculine' are highlighted. In this area, different lines of research are identified:
 - Conceptual reflections about epistemology of science from a gender perspective, in the strictest sense.
 - Studies that analyze, from a critical perspective, specific scientific fields in which the supremacy of 'the masculine' and the subordination of 'the feminine' is most evident. A paradigmatic example would be the contrast between doctors (masculine) and nurses (feminine).
- The social construction of identity and its gender biases. From this perspective, the processes of socialization which influence the construction of identity, the mechanisms of reproduction and transmission of gender roles and their impact on the attitudes that children and young people have towards science, are analyzed.

Research approaches

The social construction of science

There are many contributions dealing with the epistemology of science from a gender perspective. They question the neutrality of science and scientific activity and highlight the power relations of 'the masculine' over 'the feminine'. It is a multidisciplinary field of research, with contributions from the philosophy of science, the sociology of knowledge, the sociology of science and feminist theories of science. This line of research frames the science as a social construction and linked to the structures of power. Some of the theoretical approaches entail a hard criticism of the supposed objectivity of science, highlighting the existence of bias on grounds of gender and power relations in general in the scientific methodology and scientific paradigms. It is considered, however, that the study of science as a social institution allows to overcome most of the epistemological problems related to the relativity of all kinds of knowledge (Pérez Sedeño, 1995, 2000).

The critical revision of 'the masculine' and 'the feminine' has particularly developed in the area of medicine. During the 20th century, medicine has gradually become a feminine profession. This trend has been accompanied by an effort to recover the contributions that women have made to medicine throughout their history: both the individual contributions of female physicians and the contributions of female carers on collective or anonymous level are emphasized. In parallel to this recovery, research makes a critical revision of the social construction of medicine as a masculine profession and the subordination of nursing as a feminine activity, linked with caring which comes "naturally" to women (Ortíz et al., 2004; Trasobares and Germán, 2004). The gradual inclusion of women into professional medicine and men into nursing helps to question this dichotomy, allowing the recovery of contributions that women have made to medicine and the recognition of nursing as a profession.

The social construction of identity

Research in this field deals with the reproduction of gender roles and stereotypes during the socialization process, analyzing the stereotyped transmission of science as an activity associated with the traditional masculine attributes of 'objectivity' and 'rationality' in contrast to the feminine attributes of 'subjectivity' and 'emotionality'.

Studies in the field of education and sociology of education focus on primary socialization and the role of school, analyzing the stereotypes concerning science and scientists among pupils, as well as the teaching practices and teaching material used in schools. This literature is debtor of an intense academic discussion and debate around coeducation in Spain, which has analysed the construction of gender identity in the school sphere (Tomé and Rambla, 2001). These studies stress the need to adapt the education system to the interests of girls and/or to integrate traditional women's knowledge into the academic sphere. The objective is to 'deconstruct' the masculine stereotypes of the scientific activity and to bring it closer to the knowledge and skills that are traditionally associated with women (Sánchez Bello, 2002).

In the field of social psychology, research is focused on the analysis of cultural and individual processes involved in gender stereotyping, exploring the explanatory power of gender variables as predictor of differences in the choice of career between women and men (López-Sáez, 1994).

Findings

The main Spanish contributions to the study of stereotypes and identity in science can be summarized as follows:

- In epistemology of science, a profound conceptual debate has taken place. Nevertheless, the views are very diverse and the theoretical framework is still weak. The proposal of an alternative approach is still at the centre of discussion (Pérez Sedeño, 1995, 2000).
- A critical historiographical revision of the female contributions to modern science shows the relations between gender, power and scientific knowledge. Most women had epistemological problems with the scientific establishment of their time or had to practise science on the margins of the masculine scientific authority, working on issues not directly related to what today is understood as 'hard science' (Solsona, 2001).
- In health sciences, and more specifically in the fields of medicine and nursing, a large effort has been made to give visibility to the female contributions and to highlight how the power relations between men and women can come to structure the hierarchy of knowledge and professions (Ortiz et al., 2004).
- In the field of education it is noted that horizontal segregation remains in technological studies and is a result of the transmission of gender roles from an early age, as much in a family setting as in schools (Subirats and Brullet, 1988).
- In the field of social psychology, the relation between gender variables and typical masculine or feminine career choices is still under discussion (López-Sáez, 1994).
- The analysis of the educational practices and teaching highlights the fact that they tend to reproduce an image of science that is connected to stereotypical masculine attributes. This fact, along with the absence of female models in science and technology, has an impact on the attitudes of young boys and girls towards science, discouraging girls from entering into a scientific career, in particular in the field of technology (Sánchez Bello, 2002).

Gaps

Despite the interest in the study of the reproduction of stereotypes in the school, the proposal of methodologies and alternative tools is incomplete and its establishment is almost non-existent.

No publications have been identified about cognitive skills, which is an area of research not developed in Spain.

2.4. Science as a labour activity

Research questions

Research in this field puts particular emphasis on two questions:

- The historical analysis of the professional and personal paths of female scientists, with the aim of illustrating the relation between the professional and the private sphere.
- The analysis of gender discrimination in scientific careers, principally in academia.

Research approaches

The historical and biographical analysis of female scientists is a topic which has generated a large number of studies. They focus on the biography of well-known women in science, especially in the fields of experimental and health sciences (i.e. Sanchís Rubio, 2002, and Santesmases, 2000, among others). This type of biographical analysis is carried out by means of in-depth documental analysis of different kinds of historical texts. They study the professional and personal paths of women with the aim of showing the relation between the professional and the private spheres and identifying which elements have driven the success in the scientific career.

Literature about gender discrimination in the academia is based on theoretical contributions, as well as on empirical research about the situation of women in the universities or other public research institutions. Research in this field develops in the 1990s and, especially, the 2000s. It analyses causes and consequences of discrimination against women in their scientific careers compared with their male colleagues (de Vicente et al., 2003; García de Cortázar et al., 2006). These studies compile existing statistics and carry out qualitative fieldwork, focusing on the analysis of women's barriers and difficulties when trying to achieve academic success.

Findings

Findings are diverse, depending on which topic is approached:

- Women's scientific career starts later, progresses more slowly and is shorter than that of men. It is proved the existence of a "glass ceiling" for female scientists in Spain that avoids female promotion in scientific career in the same conditions than male promotion (de Vicente et al., 2003). Some authors refer to "overselection" of women scientists (social overselection, over-effort, over-difficulties and unequal domestic workload) (García de León, 2005).
- One of the main causes for the decline in the number of female scientists compared to the high number of female students is the difficulty that comes with balancing the scientific and personal life. Work/life balance is an important bulk of tension for female scientists. In these sense there are important differences between junior and senior scientists, being the more seniors scientists the ones that have experienced and perceived in a most dramatic way their elections and renounces (García de Cortázar et al., 2006).
- There are significant differences in family status and family decisions between men and women scientists. Female scientists are much more likely to be single than male scientists. In the same way, while male scientists have children at the same rate as the rest of population, female scientists have a lower fertility. Furthermore, research about the CSIC staff shows a high rate of homogamy and endogamy of scientists, being specially acute for female scientists (García de Cortázar et al., 2006).

Gaps

There are no theoretical nor empirical studies about professional career and gender discrimination in private research institutes in Spain.

There is a lack of empirical studies about the organization of scientific work, the uses of time and the work/life balance. These are aspects dealt with in studies about gender inequalities at work but they are hardly translated into the analysis of the scientific activity as such.

2.5. Scientific excellence

Research questions

Although only a few articles about scientific excellence have been identified, two types of issues are dealt with:

- The bibliometric studies that compare the scientific productivity of men and women.
- The studies that analyze the mechanisms by which gender bias is reproduced in the evaluation of scientific excellence.

Research approaches

Most of the bibliometric studies aim to compare the scientific productivity of male and female CSIC researchers, taking into account scientific field and professional category. Other bibliometric studies have also been carried out about medical scientific publications (Schiaffino et al., 2001) or specific journals (i.e. Santillán and Valles, 2005).

There are few studies which explicitly analyze gender bias in scientific excellence. Some of them analyse the barriers to the progression of women into the academic career, mostly by means of interviews with academics of both sexes (i.e. García de León (2005) analyses the entry of women into the Royal Academies). However, the issue of gender bias in scientific excellence has recently gained more relevance thanks to the University Autònoma de Barcelona (UAB), which held the 1st International Congress of gender bias and inequalities in the evaluation of academic quality in 2008 (see Izquierdo et al., 2008).

Findings

The main findings are the following:

- Women are over-represented amongst university graduates with the best academic records: 61% of the graduates with an excellent academic record are women, while women represent 53% of the graduates. However, even the women with the best academic records find more difficulties than their male colleagues to start a professional career. They last more time to find a job position and their employment status is more insecure (de Vicente Royo et al., 2004).
- Bibliometric studies about the CSIC staff show that there is no difference in the scientific production of men and women who are on the same professional level and in the same specialty. From this perspective it can be argued that the low presence of women in senior scientific positions cannot be explained by the difference in scientific productivity (Bordons et al., 2003; Álvarez-Marrón and Campabadal, 2004; Bordons and Mauleón, 2006).
- Women's difficulties for academic progression cannot be only explained by work-life constraints: subtle gender biases are also at work. Already in the early stages of the academic career (post-doc grants) inequalities between women and men have been reported (de Pablo, 2006). However, the evidence of gender biases is particularly clear at the top of the academic career. Women in Royal Academies are a minority within a minority, since they are severely under-represented in comparison with their presence amongst professors. The access of women to this elite is hindered by cooptation procedures that reinforce homosociability practices (García de León, 2005).

Gaps

The bibliometric studies about scientific productivity deal with the CSIC staff. There are no similar studies in the academia as a whole.

The bibliometric studies are of a cross-sectional character, and not longitudinal. They demonstrate that there are no noticeable differences in the scientific productivity of men and women in the same professional category and scientific specialty. However, this empirical

evidence is not sufficient to show the existence of gender discrimination. In order to do this it would be necessary to carry out a longitudinal study.

The barriers blocking women's access into the academic elite have been analyzed. However, the difficulties of progressing, step by step in the scientific career still need to be studied. There is a lack of studies that consider more specific aspects such as the formal and informal criteria of evaluation, the procedures of establishing the peer evaluation panels or the methods of selecting candidates at different levels, such as the awarding of pre- and post-doctoral grants, the hiring of university teaching staff or the promotion of the university teaching staff.

There are no studies about scientific excellence in the research that takes place in the private sector.

2.6 Gender in research contents

Research questions

The introduction of the gender perspective in the scientific contents is looked at from two different perspectives:

- From a historical perspective, whose main aim is to highlight the scientific contributions made by women.
- From an epistemological perspective, which aims to conduct a critical analysis of gender bias in the scientific knowledge and develop new concepts and lines of research that take the relevance of gender into account.

Research approaches

In the field of the history of science there is an abundant literature that studies the biographies of women in science and their contributions to different scientific fields (Magallón, 1998; Ortiz and Becerra, 1996). These studies do not properly deal with the gender dimension of scientific knowledge from an epistemological point of view. Their basic goal is to give visibility and recognition to the scientific contributions of women, which are often silenced. Nevertheless, they emphasize that men and women have different priorities in the development of scientific knowledge, due to different socialization and social position.

The contributions from an epistemological perspective are of a diverse nature. In some cases, the objective is to disseminate among the Spanish scientific community the international debate concerning the androcentric character of science and the conceptual breakthroughs that imply the incorporation of the gender perspective (Carrera et al, 1999; Pérez Sedeño 1995, 1999). In this line, the development of gender studies in Spain, in the fields of social sciences and humanities, has also been critically revised (García de León et al., 2007). In other cases, the aim is to develop new concepts and lines of research which highlight the relevance of gender in a certain scientific field. The main contributions deal with the relevance of gender in the social sciences and the health sciences.

Findings

Social sciences

In the field of social sciences, a large effort has been put into the dissemination of the main conceptual breakthroughs related to the international debate on gender and work into Spanish research. Over this period, there has been a development of research related to domestic work and care work, with contributions from both sociology and economics. The most developed issues are:

- The revision of the very concept of work, in order to incorporate not only paid work but unpaid work as well (Borderías and Carrasco, 1994; Torns and Miguélez, 1998).
- The development of studies about time uses and work/life balance, understood not as a private problem for women but as a societal matter, including the analysis of the unpaid work contribution to the GDP (Durán, 2000; Moltó and Uriel, 2004).

- The analysis of gender bias in social and fiscal policies, related to the predominance of the male-breadwinner model (Pazos 2005).

The consolidation of the gender perspective also opens new lines of research in other areas, namely the analysis of the social construction of identity and the reproduction of gender stereotypes, especially at early ages, with contributions from social psychology and sociology (Subirats and Brullet, 1988). However, there are also contributions of high interest in other areas, including those in which the gender dimension appears to be of little relevance on the surface, such as international relations (Rodríguez, 2000).

Life sciences

Although there are many contributions from different perspectives – neuroscience, bioethics, biology – medical contributions dominate. Amongst the most relevant aspects it is worth emphasizing:

- From the beginning of the 1990s, the need of taking into consideration the sex variable in all areas of clinical research has been established. Until this time, on many occasions the results obtained from the male population were just extrapolated to the female population without further research. However, there is still a significant number of articles in biomedical journals that do not present sex-disaggregated results (Schiaffino et al., 2001).
- There has been a development of studies on how medical practice is affected by gender stereotypes and by women's lower societal value compared to men's. When the patient is a woman, less therapeutic efforts are shown, a smaller amount of sophisticated technological tests are used as well as an excess in the prescription of psychoactive drugs appears (Ruiz and Verdú., 2004; Markez et al, 2004). These studies emphasize the fact that among medical professionals there is a deep-rooted prejudice towards the excessive tendency of women to go to the doctors, conceived as a result of biological and psychological characteristics and not of their social situation.
- The way in which medicine has developed an androcentric knowledge of human's bodies is analysed. The historical construction of the female body as reproductive, passive and pathologic affects the very concepts of illness and medical care (Cabré and Ortiz, 2008). The need of a consistent gender approach in medicine for the prevention of health inequalities is thus emphasised, with contributions that range from the critical analysis of gender stereotypes in the construction of mental illness (Vijande 2004) to the inclusion of gender (not only sex) in everyday medical practice (e.g. de la Rosa and Otero, 2004, for the treatment of smoking addiction).

Gaps

The epistemological debate about gender bias in scientific knowledge has little relation to the development of new ideas, approaches and lines of research, except in some specialties of social sciences. However, it is necessary to highlight that even relevant contributions in this field have a limited impact beyond the small circle of specialists in 'women's and gender studies'.

In the area of health sciences, the conceptual contributions are fragmentary and the development of new lines of research and their clinical application is very unequal. Even so, in different branches (from preventative medicine and general practice medicine to bioethics) there seems to be a growing interest in the analysis of how the gender inequality in society affects the health of men and women.

In the field of natural sciences and engineering, the debate on this issue is almost non-existent. The only relevant exception is architecture and urban planning. However, the relevance of gender in this area is mainly addressed through professional associationism with the aim of influencing public politics: scientific publications in the field are still scarce (the main reference in Spain is Sánchez de Madariaga, 2004, among other publications).

2.7 Policies towards gender equality in science

Research questions

Policies towards gender equality in science are relatively recent as is research on this matter. The following topics have been considered:

- Evaluation of the scientific policy and their impact on gender equality.
- Elaboration of gender equality plans in universities. For this purpose, periodic reports have been carried out to evaluate the situation and to define specific lines of action.

Research approaches

Gender equality policies have been significantly reinforced in recent years. In 2004 the General Secretary for Gender of the Ministry of Labour and Social Affairs was created; in 2005 the Unity of Women in Science of the Ministry of Education and in 2008 the Ministry of Equality. The Equal Rights Law, approved in March 2007, establishes the goal of gender equality in all social domains, with specific objectives and measures. Special attention is being paid to the equal presence of women and men in science and in the economy. The Law on Equal Rights states that companies have eight years (from the year 2007) to achieve equal proportions (40% at least of each sex) of women and men on boards of directors and selection committees, while the Reformed University Law (2007) states that all university and scientific committees must be gender-balanced.

There is no consistent line of research about the evaluation of gender equality policies in the field of science. AMIT (Asociación de mujeres investigadoras y tecnólogas; Association of women in research and technology) has played a major role since its creation in 2001 providing evidence of gender discrimination in science and claiming for a consistent gender equality strategy (see de Pablo, 2006; Pérez Sedeño and Alcalá, 2006). The FECYT (Fundación Española de Ciencia y Tecnología; Spanish Foundation for Science and Technology) has been very active in the dissemination of research about gender and science and the promotion of a gender equality policy (Alcalá et al., 2005 and 2007). However, more specific evaluation studies have only recently developed, particularly in connection with the creation of the Unit of Women and Science at the CSIC and the promotion of gender equality plans at the universities. This initiative started in the mid 2000s with the constitution of the first University Equality Observatory at the UAB, an experience which has later been transferred to other universities. The same holds true for the recent wave of studies about gender bias in the evaluation of scientific excellence.

Findings

Since the beginning of the 2000s, the Unit of Women and Science of the CSIC has been active in the promotion of gender equality in this institution and progress is regularly monitored. With regard to the universities, the UAB is the pioneer university in the field of gender equality. In 2004, this university issued the study 'Sexism in the UAB: proposals for action and information for a diagnosis' (Izquierdo et al., 2004) and approved in 2005 'The First Plan for the Equality of women and men at the University Autònoma of Barcelona 2006-2007', aimed particularly at the policies in the areas of teaching, research and working conditions. It is suggested that the teaching staff should be the object of preferential attention for two reasons. On one hand, it is the group in which the inequalities are most pronounced, as much in terms of segregation by areas of knowledge as in terms of inequality in academic career and presence in the decision making bodies. On the other hand, it is considered that the actions aimed at this group have a positive impact on the whole University, and namely on the students.

The increasing relevance of gender equality policies in science has enhanced the development of instruments, tools and 'guides' to promote gender equality at the universities and research centres. GIOPACT (Grup de Recerca d'Igualtat d'Oportunitats en l'Arquitectura, la Ciència i la Tecnologia; Research Group for the Equality of Opportunities in Architecture, Science and Technology) has developed a comprehensive guide for designing, implementing and monitoring a gender equality plan at the university (Martínez et al. (2006), as well as a methodology for the

assessment of jobs in academia and private business that avoids gender bias (Corominas et al., 2000).

Gaps

It is a new area of research in Spain, just like the establishment of gender policies. Policies towards gender equality in science are at the implementation phase as is their evaluation.

3. Conclusions

One of the main area of research is the theoretical study of science as a social construction. From this perspective, science is conceived as embedded within power structures, its objectivity and neutrality is questioned and the existence of gender bias in the scientific methodologies and paradigms is stressed. However, in spite of the intense conceptual debate, the development of alternative approaches is in phase of discussion.

A growing interest in the analysis of horizontal and vertical gender segregation in academia is also noted. Women account for more than half of university graduates since the beginning of the 1980s and their presence has continued to grow since then. However, the scarce presence of women in certain fields of science and in senior positions still persists. In recent years, many studies have been carried out in order to compile sex-disaggregated data and provide descriptive evidence about the persistence of horizontal and vertical gender segregation in science.

Analytical research on this field is nevertheless fragmentary. One of the main lines of research deals with the transmission of gender stereotypes in early socialisation processes and their influence on the choice of educational paths. Research in this field attempts to explain why boys and girls choose different educational paths, with girls being in the minority in technical studies. On the contrary, the analysis of the mechanisms of vertical segregation in science is more recent and less developed.

Taking into account the most recent contributions on gender and science in Spain, the following gaps are noted:

- There is a lack of research about the private sector. Research on gender and science has been carried out almost exclusively in the academia (universities, CSIC, and Royal Academies). The only exception is medicine.
- There is a complete lack of longitudinal studies regarding scientific careers. The barriers blocking women's access to the elite in academia have been analyzed. However, the difficulties faced when progressing, step by step, in the scientific career still need to be studied. There is a lack of studies that consider more specific aspects such as the formal and informal criteria of evaluation, the procedures of establishing the peer evaluation panels or the methods of selecting candidates at different levels.

However, the main deficit of gender and science research is the fact that the conceptual debate has not sufficiently driven empirical research in many relevant issues:

- Research concerning the mechanisms that explain horizontal segregation in the educational paths is far from conclusive. The same holds true for the development of alternative methodologies and teaching tools to avoid the reproduction of gender stereotypes.
- The effort to compile data has not sufficiently driven the development of gender indicators.
- There is a lack of empirical studies about the organization of scientific work, the uses of time or the work/life balance. These are aspects dealt with in studies about gender inequalities at work but they are hardly translated into the analysis of the scientific activity as such.
- The epistemological debate about gender bias in scientific knowledge has little relation to the development of new ideas, approaches and lines of research.

- In health sciences, it has not been clearly outlined what it means to introduce the gender dimension into the scientific knowledge. The conceptual contributions are fragmentary and the development of new lines of research and their clinical application is very unequal.
- In natural sciences and engineering the debate on this issue is almost non-existent.

On the other hand, there are research topics hardly addressed at all:

- Pay and funding: Research in this field has barely even begun. There are no recent studies about the gender pay gap and gender discrimination. The inequality in the access to funding has only recently started to be analysed.
- Policies towards gender equality in research: it is a line of research in its early stage in Spain as is the development of gender equality policies in science.

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