



Meta-analysis of gender and science research

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Introduction

The question of women in science was quasi inexistent until the 90s even if the gender focus gained relevance in the 70s. It was under the impulse of the European community and of the Federal Government that the issue became relevant, also for feminist studies. Research in this area appeared as soon as the political authorities recognized and supported the importance of the topic. However, as Belgium is a federal state, Equal opportunities matters are a competence that is distributed between the Federal State and the federated regions (for economic matters) and communities (Flemish, French and German speaking). Educational policy is no longer a federal competence but a Community competence. This situation entails a difference in the scope, funding and impact of research on gender equality in education between the north and the south according to the importance given to equality policies by the political authorities.

The absence of a collective process and approach is one of the main reasons why since the 90s the research on women in science knew a slower expansion in the French speaking community than in the Flemish speaking community.

From 1990, one can observe a proliferation of descriptive studies on women in universities and the creation of centers for feminist studies in universities. In Flanders, two sorts of studies were carried out on this topic. On the one hand, there are the studies about the situation of women in all Flemish universities, financed by the public authorities (Vanherck, R., Verbruggen, P. & UIA Vrouwenstudies, 1991; Elchardus, M., Huysseune, M. & Scheys, M. 1991; Van Haegendoren, M., Valgaeren, E. & Noelanders, S. 2000; VLIR - Werkgroep Gelijke Kansen 2002). On the other hand, in the framework of a pilot project at the Flemish university of Leuven there is a recent series of studies on the place of women at universities (Centrum voor Gelijke Kansenbeleid, 1999; 2000; 2004). The first broad study in the French speaking universities appeared only in 2003 (de Hénau J., Meulders D.).

Apart from research on women in universities, there are also a number of studies on women in scientific professions or fields. These studies remain relatively sporadic and punctual.

Horizontal segregation

Research questions

The research focuses on the underrepresentation of women in some specific areas and disciplines. Two issues are especially studied:

- The analysis of the gender horizontal segregation in educational field (secondary education and higher education).
- The analysis of the gender horizontal segregation in professional field.

Attention is given to the share of women according to the field of study. This reflects different interests between men and women. Special attention is given to fields such as mathematics, physics and computer sciences. Concerning the professional field, one focuses on the share of women in occupations such as engineer, the medical profession, academic position or occupations in the ICT sector.

Research approaches

The research approach is mainly descriptive, based on compilations of data or on the results of large surveys. The research is often associated with a deeper analysis of the reasons that can explain this underrepresentation of women in certain fields of study (analysis of the motivations in the choice of study), or in certain professional status (mechanism of vertical segregation; obstacles that women met in their career). These questions are analyzed through the use of quantitative methods (survey based on questionnaires; bivariate and multivariate analysis).

Longitudinal data are often used in order to show the growing presence of women in universities (“massification” and feminization of universities), in disciplines and to show the evolution between generations.

Findings

Considering the most recent data, the situation can be summarized as follow:

- The number of women in higher education has strongly grown for the past 50 years. The percentage of female students in Belgian universities is now equal to or higher than the percentage of male students.
- The representation of female students differs largely according to the field of study. They are underrepresented in faculties of science (especially in exact and applied science) and informatics. Since the last 50 years and in comparison with other faculties, the number of women in science faculties has grown very roughly. Women prefer disciplines like human sciences, medicine and pharmacy. The phenomenon of predominantly ‘female’ and predominantly ‘male’ subject areas still persists. This is also the case for the academic and scientific staff in universities.
- This segregation takes its roots at an early age when students choose their educative path in secondary school.
- One can observe a rise of the percentage of the feminine scientific and academic staff in faculties of human sciences. This rise is faster in human sciences than in applied sciences and informatics.
- Since ten years, among the women who have a degree in applied science, the proportion who want to work in research is rising.

Gaps

One can observe a lack of longitudinal data and research in general on women doing research in other institutional sectors than universities (private or governmental sector).

The research could insist more on the evolution of the horizontal segregation in different educational levels and also in for the staff of university faculties.

Vertical segregation

Research questions

This topic contains the most important research and entry of publications in Belgium. Two important issues are considered:

- The analysis of the gender composition of the staff in one type of institution: universities.
- The analysis of the horizontal segregation in the progression of careers of women.

Here the research is mainly dedicated to the understanding of the reasons of the absence or the extremely low presence of women in leadership positions in science and technology. Effectively, the higher up in the hierarchy, the fewer women will be represented. An important part of the research is dedicated to the study of the structural barriers that systematically appear to exclude women from developing their careers. Areas of research are mainly universities. The phenomenon of the “glass ceiling” is often described and analysed.

Research approaches

Different kinds of approaches are used to study this issue. First the description of the situation is made through data collection provided by institutions or through a quantitative survey. Longitudinal data are privileged. In some cases, in order to understand the nature of the mechanisms preventing women from developing their careers, qualitative methods, mainly interviews, are carried out. The aim here is to fill the gaps in the explicative power of the descriptive work.

The empirical observations are in most cases compared to the scientific literature on vertical segregation.

The Flemish Interuniversity Council is using indicators in order to measure the glass ceiling.

Findings

Considering the most recent data and studies in both Belgian communities, the situation can be summarized as follows:

- Whereas over half of all students in the first cycle of university studies across all faculties are female, their numbers decline progressively as the level of study rises. The gradual disappearance of women starts at the postgraduate and doctoral level. The number of women continues to decline as we grow in the hierarchy of the institution.
- The highest drop-out rates (leaky pipeline) exist in the most female-dominated subject areas. The increasingly rare presence of women at the postgraduate and doctoral level is relatively less marked in the science faculties.
- Especially the row of professors and full professors are still impregnated by the academic men's culture. One can speak about the persistence of a "glass ceiling" so that the idea of a natural catch up of women on men in higher academic functions has to be rejected. The first obstacle is to get a tenure, the second one to become full professor.
- The earlier actions for improving gender equality will be undertaken during the educational path, the more the inequalities at upper levels will be reduced with time.
- In all universities, women are quasi absent in decision bodies and in responsibilities functions. The overrepresentation of men in these instances overtakes those observed in scientific and academic staff. There is a link between this absence and the underrepresentation of women in the top levels of the academic career.
- The authors underline the existence of a "Matthieu effect" to indicate that initial differences are strengthened throughout the professional career of women and men.
- The glass ceiling appears to be stronger in the ICT sector.

The causes of the underrepresentation of women are attributed to two kinds of factors. On the one hand, internal factors of the institution are mentioned such as the absence of women in scientific committees, decisions bodies and in responsibilities functions (the overrepresentation of men in these instances overtakes those observed in scientific and academic staff) or the indirect discrimination in the male-oriented staff policy. On the other hand, external causes such as the private life are mentioned but less privileged.

Gaps

The research is mainly based on women in academia. Few studies have been carried out in the ICT sector. Research in this area must continue. There is a lack of survey on gender in other scientific professions, other kind of institutions and in the career of researcher.

With time, one can speak about a better comprehension of the problem, but it remains in the limit of the classical analysis of the obstacles to equality. The research on the factors linked to the vertical segregation must then be deepened, especially in the French speaking community

where only one large study (which includes all French speaking universities) has been carried out.

Gender pay gap

Research questions

The research is mainly oriented towards access to research funding and the inequality between men and women to this access. The question of the gender pay gap in what concerns scientific or research positions is at this time not developed even if this issues have already been analysed for the labour market in general.

Research approaches

The research approach is principally descriptive and based on statistical data provided by institutions. A manual for gender mainstreaming proposes various indicators to monitor whether the distribution of financial means – such as research grants and pay packages - are equally accessible to women and men.

Findings

The gender pay gap is briefly mentioned in few Flemish reports. Except for professors and full professors, the presence of women is higher in lower levels of salaries. This results from a subtle sort of discrimination. *“Many women are ambitious. They want to be promoted, to have a better salary and to conduct more interesting projects. Only, they never ask for it. If a man has higher aspirations, he simply says so. Take your destiny in your own hands and dare to ask¹.”*

In what concerns the access to research funding, the selection of the candidate is made in scientific commissions that are mainly exclusively masculine (93% of men at the FNRS). The percentage of accepted demands (the granting of funds) is equally distributed between men and women. However, the propensity of woman to apply is lower than men, when they are eligible.

The access to these funds is harder as the position is higher in the hierarchy. Access to a long term position is more difficult for women than for men.

In 2003, at the FNRS (National funds for scientific research), the percentage of women was 37% for scientific collaborator; 21% for research fellows and 27% of skilled researchers (long term position).

The Flemish Fund for Scientific Research (Fonds Wetenschappelijk Onderzoek) has already taken measures in the framework of its policy for equal opportunity. During paternity-, maternity and breastfeeding leave, palliative and long-term sick leave, the mandates are suspended and extended with the not performed period.

Gaps

Research and data on the gender pay gap in all scientific and research occupations is totally missing. Nothing has been produced on the private sector.

One can underline a lack of regular, systematized, sex disaggregated and longitudinal data on the granting of funds for all the Belgian applicants.

¹ Van Wesemael, Y., De Metsenaere, M., Lievens, S., Pyck, H., Vandenbussche, L., Hiel, E., Van der Auweraert, A. & Nielandt, B. 2008, *Equality Guide. HR Instruments for Equal Opportunities at Universities*, Garant, Anvers.

Stereotypes and identity

Research questions

This question appears in many research carried out in Belgium in order to explain the reason of the horizontal segregation and the differences in choice of career. A large panel of factors appears in order to explain that phenomenon. First, the question of gender stereotype and the existence of professions or fields associated with typical male and female characteristics is an issue which is relatively often approached. This is the issue that generated the most research. The scientific field for which these questions have been the most treated is engineering. Second, the idea that women and men think and decide differently when it comes to individual benefits because women often have to combine their career with running the household and child care constitutes another factor of explanation. The question of the role models and the influence of the society as a large is also mentioned in several studies. It is mainly the role of the family (and more precisely of the parents) which is analysed.

As far as the social construction of science is concerned, the question of its neutrality and of its potential discriminative aspect that creates a subordination of the feminine to the masculine has been discussed. The role of the school and the educational system on the transmission of stereotypes and inequalities has been studied.

Research on cognitive abilities has also been carried out, especially in the field of mathematics.

Research approaches

For the analysis of the incentives and the motivations in the choice of the study or the career, qualitative methods such as interviews are privileged. In this case the research approach will be sociological or psychological. Quantitative studies have also been carried out through questionnaire surveys and in deep statistical analysis (multifactor analysis).

The main approach for studying the social construction of science is historical, philosophical and epistemological.

Findings

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

- As already discussed above, the educational choices show a clear male-female difference. One can speak about deeply anchored stereotypes shared by women and girls on the career prospects of certain scientific professions.
- These stereotypes find their origin at the early age in the social context and at school, which still plays an important role in the construction and the reproduction of the gender stereotypes and social roles. The interaction between students and the teacher and also the teaching material constitutes an important vector for the transmission of these stereotypes. One may also mention a lack of female models in science.
- The consequence is that youngsters often have no idea or an inaccurate idea of to what kind of job a study orientation can give access to.
- The familial context and the occupation of the parents is also identified as an influential factor in the transmission of the role models. Furthermore, female students turned out to be more sensitive than their male colleagues to the opinion of their parents and their teachers.
- Girls tend to under evaluate themselves and their capacities more than boys, especially in domains traditionally masculine connoted. Girls also think less than boys that they

have the capacity for exact science (even if their results are not worst than those of boys). This can be a consequence of the role models.

- Girls are less attached than boys to materialistic factors such as work full time or to gain an important income. They find contact with people really important which is less the case for boys.
- The idea that the scientific and technical careers are less compatible with the private life is more widespread among girls. There is a rational and realist calculation when they are confronted to the duality of their familial and professional role and to the necessity of establishing priorities.
- Science has been criticized in its neutrality and objectivity because it remains andocentric. It became discriminating when the gender dimension and its implications are not taking into account.
- As far as the cognitive skills are concerned, boys scored higher than girls in mathematics. This advantage in mathematics achievement emerges during secondary school, as students are gradually given greater subject choices. On the other hand, research on stereotype threat has convincingly demonstrated that reputations of lower ability in academic domains can significantly contribute to the underachievement of students targeted by such reputations (in this case, women). This asymmetry in achievement results more from a situational predicament than from a stable predisposition be it genetic.

Gaps

Empirical evidences on the origin of the horizontal segregation in the first levels of education and of the mechanisms of its reproduction should be search. Research on concrete actions and strategies that can counter the reproduction of stereotypes must be deepened.

Research on the culture of universities and other institutional areas that supports stereotypes could be deepened.

Science as a labour activity

Research questions

This topic has been studied very partially. The analysis focuses on gender discrimination and vertical segregation in scientific career (essentially in academia) and on the obstacles that are met by women in their career progression. The questions of their perception of these obstacles and of the combination of their private and professional life have also been discussed.

Research approaches

This issue is mainly studied through the analysis of qualitative material such as interviews. It appears also in quantitative surveys as an explicative variable for the analysis of progression in the career.

Findings

The main findings are the following:

- To the question of the obstacles in the career, women and men mention the same factor but in a different order. The first obstacle mentioned by women is the household and the family. However, a gap exists between the perception of women who feel

familial charges as an obstacle and the real impact of these charges on feminine careers.

- Having children can play a stimulating role in the career ascension. Among women having get a long term position, the majority are married with children. Married women are more promoted and publish more than single women.
- The presence of children can also be a difficulty when domestic work is not shared with the partner. The share of the domestic task in the couple is a solution for the organisational obstacles.
- Women did their professional stay in foreign countries before having their first children.
- The academic life is not easy to combine with the family life (evenings meetings, judgement and appreciation by superiors are generally unfavourable to maternity leave, parental holidays or part time work, no replacement during the maternity leave which rise the work load when coming back, a staff policy that does not take this aspects into account). The relative freedom for managing the time allocated to researc contrasts with the strong and continual requirements of the scientific work, to the detriment of a serene articulation between private and professional life, particularly for women. Another difficulty could be that the maternity age coincides often with the redaction of the doctoral thesis which constitutes a difficulty for women.
- The academic culture is not sufficiently family oriented. Family tasks are underestimated.

Gaps

The lack of longitudinal and systematized data has to be underlined. On the total of the concerned population very few have been questioned on how they perceive the combination between the family life and their professional life. This kind of qualitative research must be enlarged.

However, the ambiguity is that this information would be subjective. Research on the gap between the perception of women who feel familial charges as an obstacle and the real impact of these charges on feminine careers must be carried out.

The working culture and its implication on the family life in other areas than universities is absent.

Scientific excellence

Research questions.

The concept of scientific excellence is approached when studying the system of promotion in the career. The topic especially covered is the institutional practices of evaluation, when analyzing the vertical segregation and gender discrimination. Selection criteria and bias in the evaluation have been analyzed in this respect.

No clear definition of excellence is proposed.

This scarcely research examines the situation in universities, other institutional areas has not been studied.

Research approaches

The approaches are multiples. Some studies are based on descriptive statistics on the number of women in evaluation committees for example. Some others are qualitative and quantitative, based on surveys with both closed and open questions.

Findings

Here are the main findings of the research carried out in Belgium:

- There is a lack of transparency in the selection criteria and the qualification, the profile for the function and the process of evaluation.
- It is difficult to find convergent elements in the advancement and selection procedures. Three elements appear to be important: the teaching, the research and the services to community. On the other hand the conditions for admission are based on seniority, the possession of a doctorate and the occupied function.
- In what concern the number of publication among full professors, few differences appear between men and women.
- The stays in foreign countries seem to be equally distributed among men and women. No negative correlation is identified between the productivity and the number of children.
- Evaluation committees are mainly composed by men. Women are strongly underrepresented in these committees.
- Women and men have the same chance of becoming appointed, but there are less female candidates that actually apply compared to the number that could have applied. This could mean that fewer women within the university are encouraged to apply for an appointment compared to men.
- No gender discrimination in the procedure is explicitly identified (direct discrimination). However, the non taking into consideration of the gender dimension and its implications constitutes an indirect discrimination.

Gaps

The analysis through qualitative survey of the mechanisms by which gender bias is reproduced in the evaluation of scientific excellence must be carried out with bigger sample of professors. The equal probability between men and women of getting appointed is still discussed. Research must be deepened on that question.

Bibliometric studies are absent. No definition of excellence is provided.

Research and data on potential productivity differences between men and women at the different stages of the career are missing.

Gender in research contents

Research questions

The unequal relations between men and women in science have been reported into numerous researches. This topic is approached in many publications devoted to the biography of various scientific women but is rarely treaded as a main topic. The question is generally to explain how they construct their career and contributes to science with an insistence on the difficulties they met in a world nearly exclusively masculine.

Several works have been done to conduct a critical analysis of gender bias in science and scientific research and develop new concepts and lines of research that take the relevance of gender into account.

Research approaches

The research approach is mainly historical, sociological and epistemological.

Findings

The main findings that may be underlined from the research carried out in Belgium are:

- Culture and education were for a long time refused to women because of their “nature”, or “mission”. Many contributions explain the effort made by certain women to get out of these stereotypes.
- Since centuries our culture has been constantly anchored by a dualistic thought tradition: the masculine is associated with objectivity, reason and science and feminine, with subjectivity, emotions and nature. The critic of science in a gender perspective is an attempt to analyze the origin, the power and the consequences of this dichotomy in relation with science.
- At the beginning of the feminist movement, publications questioned and criticized the exclusion of women from the social and political life, but the interest into the repercussion this problem imply on science (which is strongly associated to masculinity) was very low. The epistemological question of the neutrality and objectivity developed later on.
- Since 1980, two questions are at the centre of the attention: where is the origin of the link between masculinity, objectivity and science? In what terms is the connection drawn up between scientist and the object of his study?
- Studies about work/life balance has not to be understood as a private problem for women but as a societal matter.

Gaps

The research and collection of empirical evidences in what concern the gender in research content must be stimulated and deepened as well as its particularities for each scientific discipline.

This area of research is has a limited impact beyond the small circle of specialists in “women’s and gender studies”. However it could be relevant to enlarge this circle to all actors concerned.

The research in this area concern science in general. There is no publication about gender and specific fields, like life sciences, technology...

Policies towards gender equality in research

Research questions

Policies towards gender equality in science are very recent as is research on this matter. The main topic that has been considered is the elaboration of recommendations on actions and strategies to adopt for a better gender equality in universities. Gender equality plan in university have been elaborated, especially in the Flemish community, for which periodic reports and advices are carried out to evaluate the situation.

Research approaches

The research approach is mainly pragmatic. After a period of collection statistical data on gender equality in universities during the 90 (for the Flemish community, the collection of data was carried out later in the French speaking community), the objective is to generate effects

and concrete results on the amelioration of the place of women. This can be seen in the important place of recommendations and propositions of measures in reports and studies.

In general, one can speak about a better comprehension of the problematic while staying in the classical analysis of the obstacles to equality.

Findings

Due to the fact that education is a competence delegated to the different Communities (French and Flemish) since 1989, the research on gender equality in education will differ between the north and the south according to the importance given to equality policies by the political power. This results in an inequality in the gender equality policies in their scope, funding and impact.

Although there is no legal base that requires a balanced representation of men and women in universities, gender equality policies in universities have been developed especially in Flanders. An institution such as the Flemish interuniversity council (VLIR - Vlaamse Interuniversitaire Raad) in Flanders which carried out studies and data on equality of chances for all Flemish universities does not exist in the French speaking community.

One Flemish university (the Catholic University of Leven (K.U.Leuven) started in 1999 a general policy of gender mainstreaming among the institution. This university is engaged in a large reflexion on how to apply this principle within the university. It is the only Belgian university that has the instruments to carry out such equality policy: a center for equality with financial means and an administrative structure with researchers and a rector adviser. The University of Hasselt or the one of Antwerp are at the starting of such institutionalization with their center for equality of chances.

In the literature concerning the representation of women in universities, the problem was perceived in a first time as delay problem. Later the hypothesis of a spontaneous catching up of women on men's positions in the hierarchy was rejected because of the resistant glass ceiling. Authors then start to question the entire university system as its culture and argue the necessity to modernize it. The first actor identified for creating these changes is the university itself. A bottom up approach is preferable that a top down approach. The notion of management in diversity became to take an important place in the recent literature.

Gaps

The research on gender equality policies in science is very recent as the establishment of these policies. The implementation phase has started in only one university as well as its evaluation.

Conclusion

Research on women and science is a relatively new subject of study in Belgium. The question became significant at the end of the 80s under the impulse of the political power giving more attention to the issue of gender equality. As we have seen before, the political impulse differs from one community to another. One can say that more publications and researches have been generated in the Flemish community and that there is heterogeneity in the geographical coverage of the research. The principal cause of this difference is the degree of recognition and funding to feminist studies which is linked to the establishment of equal policies for men and women. However, the similarities prevail over the differences.

Most of the publications analyses the representation of women in one type of institution: the university. During the 90s, the research was mainly a description of the situation on the basis of the statistical data collected. It was more statistical evidences than a real empirical knowledge of the causes of the vertical and the horizontal segregation. One can observe an important rise in the production of publications after the end of the 90s. At that moment, the research starts to focus more on the functioning of the institution and its discriminating mechanisms. It is mostly pragmatic approaches attempting to find potential places for intervention in order to ameliorate the situation.

In what concern the recommendations, two different visions are appearing. On the one hand there is the idea of doing science differently by recommending another scientific model; and on the other hand, to eliminate the discrimination that prevents women to build an academic career as men do.

From a methodological point of view, most of the studies are descriptive and empirical. It consists of a first statistical part and then a part on the field which is often a survey through questionnaire in order to complete the explicative gap of the statistical data.

As far as the gaps in research are concerned, it appears clearly in Belgium that research in other areas than the university such as the private and the governmental sector are totally missing except very few recent publications analysing the situation in the ICT sector. There is a lack of accessible, systematized, sex disaggregated and longitudinal data on women in science and research in these sectors. Finally, while the research on vertical and horizontal segregation appears to be abundant, some topics were very scarcely studied such as the gender in research content, science as a labour activity and mostly the scientific excellence and the gender pay gap.

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