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The scarce representation of women university professors in research groups

María José Rodríguez-Baiget[1], Alexander Maz Machado[1], José Carlos Casas del Rosal[1], Arnaldo Vergara-Romero[2]
[1]Didactics of Mathematics, Department of mathematics, Faculty of Education Sciences, Universidad de Córdoba, Córdoba, Spain
[2]Center for Sustainable Development, Universidad Tecnológica ECOTEC, Samborondón, Ecuador

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ABSTRACT

Women university teachers in Spain simultaneously have teaching and research careers that interrelate to develop their competencies in both fields. However, as in other fields, there is not yet gender equality in representation and leadership. This paper presents a descriptive analysis of the presence and role of female university teachers-researchers in the different research groups of public universities in the Autonomous Community of Andalusia that apply for competitive calls for projects, according to the different fields of knowledge to which they belong. A total of 2,445 research groups in nine universities were identified. The largest number of groups belonging to the Humanities field. Among the members of all the groups, there is a lower presence of women compared to men. There is also a negative gender gap in the roles of responsibility and management of research groups, which is reflected in both horizontal and vertical segregation and the existence of a glass ceiling for Andalusian female teachers.

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Corresponding Author:

Arnaldo Vergara-Romero
Center for Sustainable Development, Universidad Tecnológica ECOTEC
Vía Samborondón, km. 13.5 090150, Samborondón, Guayaquil, Ecuador
Email: avergara@ecotec.edu.ec

1. INTRODUCTION

The university plays a fundamental role in the development and creation of scientific knowledge. It is also a critical element in the transfer of knowledge and technology to the private sector and society at large. For example, some authors point to the existence of a model called the triple helix, according to which there is a relationship between the university, the state and industry [1], [2]. This development of scientific knowledge is carried out by university faculty in their dual role as teachers and researchers. To do this, the faculty needs both good organization and good management. In the university centers, this falls to the research groups, supported by the scientific policies of each university. However, different analyses show that the development of knowledge management correlates with the degree of support for the personal and relational competences of its members [3]. It is therefore essential to know the scope and scientific progress of university research groups, as well as how they operate and are managed.

The work of research teams transcends university boundaries, as research in teams facilitates collaboration with teams from other universities. It increases visibility and scientific production through inter-institutional collaboration [4], which benefits individual researchers in their curriculum, the research group and the institutions themselves [5], [6]. Thus, the purpose of research groups is to collaborate and carry out processes for the creation and dissemination of new knowledge [7]. However, the internal roles and working mechanisms of research groups are not very transparent as pointed out by Jeong and Choi, who

define them as a black box [8]. For this reason, it is essential to deepen the knowledge of different aspects of both collaboration and self-management.

In the current university context, there is a growing concern to promote equality between male and female faculty in all areas. At the beginning of the 21st century, due to specific development and support programs, women were beginning to position themselves as collaborative, competitive and entrepreneurial managers in response to changes in university cultures [9]. Some research warns that bias against women in academia, which is a widely documented phenomenon, has detrimental consequences for women and the quality of science [10]. They also suggest that gender bias and related research may be underestimated within the academic community.

Although men and women now share laboratories, research facilities and workspaces in most disciplines at university level, gender diversity still presents many challenges and opportunities [11]. Therefore, careful management of all processes related to knowledge generation, training and work-related aspects, and of course their internal administrative management, is required. Recently, there has been a debate in various academic and scientific fields on how to implement gender mainstreaming and diversity management in university centers [12]. There has been a call for university policies to place greater emphasis on addressing gender diversity at the institutional level in universities [13]. At the university level, gender policies are primarily developed around the academic careers of faculty, from recruitment to initial teaching positions to promotion to full professor [14]. In recent decades, academic and research work has undergone many changes and is subject to different kinds of pressures, both labor and professional, and for teaching and research accreditation processes.

On the other hand, a number of stereotypes about the role of women in academia persist, often perpetuated by the dominant hetero-patriarchal cultures in higher education [15], [16]. In the academic literature, the term glass ceiling has been coined to refer to all those unwritten policies or rules in the functioning of organizations that make it difficult for women to access top leadership or management positions. According to Bonawitz and Andel, "equity and parity have not been achieved, especially in the ranks of full professors, where the stakes are highest and where the future of academic women is most at stake", and therefore state that the situation in the university system is so obvious that the glass ceiling in universities is actually a cement ceiling [17].

The three main aspects that affect the so-called glass ceiling are i) Personal barriers which are mainly referred to as the difficulty of reconciling personal, family and professional life; ii) Organizational barriers and structural aspects which include a misogynistic context that materializes in sexist and discriminatory attitudes towards women; and iii) Social barriers which are characterized by living in a context of historical discrimination against women, where socialization is differentiated according to gender [18].

If discrimination against women in academia is widespread, it is even more pronounced in specific fields of science. Several studies indicate that women are underrepresented in science, technology, engineering, and mathematics (STEM) fields, and even more so are women from minority groups, such as African American, Hispanic, or indigenous women [19]. In addition, some of the common stereotypes and biases that women in STEM face have been identified [20], such as: i) men are better at STEM than women; ii) women are not interested in science careers; iii) successful women behaving in masculine ways; iv) gender bias in peer review; v) gender bias in applications; and vi) gender bias in promotions.

These barriers are present in both developed and developing countries, such as the Netherlands and Germany [21]. González and Pau compared the presence of women in science and technology systems in Spain and Germany. They found that in Germany, women researchers have difficulties in accessing the early stages of their academic careers. In Spain, however, women are “gradually overtaken by their male counterparts to end up as a minority in the top positions” [22].

In this sense, mixed-gender research teams offer the benefits of gender diversity; these benefits refer to the different ideas, beliefs and perspectives that women, men and gender-diverse individuals bring to the team [11]. Some studies suggest that integrating sex and gender analysis into research can open the door to discovery and innovation in research design from the outset [23]. In addition, the inclusion of women in scientific research teams has been found to increase the success of the teams [24], [25]. Numerous researchers have called for diverse approaches to the study of women in teams [26], [27], as many studies conclude that attitudes that perpetuate gender inequality continue to be reproduced in teams. Indeed, despite the various policies implemented by the Spanish government and universities, academic careers in higher education in Spain are not the best example of equality [28].

With regard to previous work on research groups at university level, it should not be forgotten that these have been the subject of studies in some countries. In some cases, they have used indicators of scientific production to evaluate them [29]. In other cases, they have tried to determine the relationship between the results of scientific production obtained by research groups and certain variables, such as knowledge management and technological capital [30].

A study on the composition of research groups at the University of Cordoba found that women represented only 41.05% of all group members. There was also a bias in favor of men in the leadership of the different groups, as men were responsible for 75.8% of the groups, while women were responsible for only 24.1% [31]. Another study that analyzed the presence of women in the research groups of the University of Malaga found that in the groups in the area of technology and production, where 83.93% are made up of men compared to 16.07 of women [32]. However, it was noted that there are areas where there is practically equality in terms of gender. Thus, in the agro-food area, men represent 49.09% and women 50.91%, and in the humanities area, men represent 46.33% and women 53.67%.

In Autonomous Community of Andalusia (Spain), there are 10 public universities where research processes are promoted through research groups and different policies and strategies for inclusion and gender equality. The former through the research services of the university and the latter through the equality units of these organizations. In these universities, women represent 40.94% of the total research teaching staff (RTS), while in all Spanish public universities' women represent 42.69% [33]. Although these percentages are very similar, the equal representation of women seems to be far from being achieved in both cases.

The aim of this study is to analyze the presence of female teachers in the research groups of the public universities of the Autonomous Community of Andalusia, recognized in the Andalusian Research Plan (ARP), as well as their presence as Principal Investigators (PI) in these research groups. This role is closely linked to their academic career, as the requirements to become a PI of a research group are a PhD and a stable contractual relationship with one of the Andalusian universities. Furthermore, there is no established procedure for the election of a PI or his/her succession. In addition, the election of this person within the research group is decided by the members of the group, usually by consensus, or in the case of several possible candidates, by a simple vote.

2. RESEARCH METHOD

This study is exploratory and ex post facto in the sense that the variables of gender and type of research group were not manipulated. The study population consists of all teaching and research staff (RTS) belonging to a research group registered in the ARP. In order to obtain the information, we consulted the information on all the research groups of the Andalusian universities, which can be accessed through the websites of the universities themselves. This information was downloaded and an ad hoc database was created for systematic management. The data were cleaned manually and a process of standardizing the names and identifying the sex of each subject was carried out. SPSS 19 software was used for the statistical treatment of the data.

It is important to note that most group websites list the names of their members. However, only sometimes is the position, the type of contract held or the link to the reference university indicated. Therefore, the list sometimes includes fellows, collaborators, and even administrative and service staff who are working to develop the group's objectives but who do not have a contractual relationship with the university's teaching and research staff. Also sometimes included are collaborators from other universities who cannot formally belong to the groups due to ARP rules, as well as retired researchers. This makes data cleaning a very laborious process. The relevance of including each case is assessed on a case-by-case basis, using a manual process that requires meticulous research. For this purpose, the consistency of the information is compared with different sources, if available, and all the principal investigators of the research groups whose composition is in doubt are contacted by mail or telephone. On the other hand, it should be noted that the International University of Andalusia does not currently have a research group. This is due to the specific characteristics of this university, which does not have its own RTS.

3. RESULTS AND DISCUSSION

There were 2,445 different research groups found, belonging to one of the 9 Andalusian public universities that have them and are present in the ARP register. The University of Seville has the largest number of groups with 602, almost a quarter of the total, followed by the University of Granada with 532. The University of Huelva, on the other hand, has the smallest number of groups, with only 96, detailed in Figure 1. If only universities with research groups are considered, the average number of groups per university is 271.7 (181.2).

In the ARP, research groups are grouped into nine macro fields of knowledge. It can be seen that almost half of all research groups in Andalusia correspond to humanities and economic, social and legal sciences (47.1%), as shown in Table 1. The macro field agri-food (AGR) is the one with the lowest number of research groups.

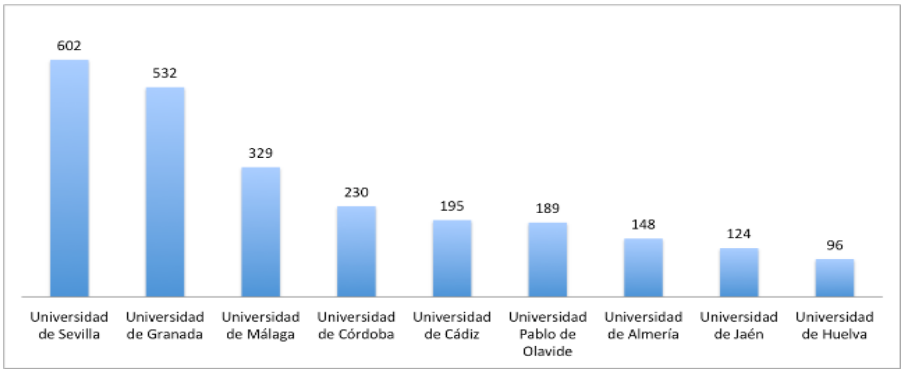

Figure 1. Number of research groups per University in Andalusia

Table 1. Number of research groups by macro-areas

Macro-area of knowledge	Frequency	Percentage
HUM – Humanities	700	28.63
SEJ – Economic, Social and Legal Sciences	451	18.45
CTS – Health Sciences and Techniques	328	13.42
FQM – Physics, Chemistry, and Mathematics	243	9.94
RNM – Natural Resources and Environment	189	7.73
TEP – Production Technology	154	6.30
BIO – Biology and Biotechnology	141	5.77
ICT – Information and Communications Technology	133	5.44
AGR – Agri-Food	106	4.33
Total	2,445	100

All these groups are made up of 26,468 researchers from Andalusian universities. Of these, 76.47% are men and the remaining 23.53% are women as presented in Table 2. Overall, women are in the majority only in the macro field of BIO-biology and biotechnology (51.12%). In the other fields, men are in the majority. In the macro-areas combining TEP-Production Engineering and ICT-Information and Communication Technology, the representation bias in favor of men is even more pronounced. In the latter, there are only 415 women for every 1349 men. It means that women represent only 23.5% of all researchers. In other words, only one in four people who comprise the groups in this macro-field are women. The situation is similar in TEP-Production Engineering, where women are severely underrepresented. Only 537 women compared to 1265 men, i.e., less than 30% of the total. The differences in FQM - Physics, Chemistry, and Mathematics are also considerable, with the percentage of women being just over 38%.

When the number of research groups per macro field is related to the total number of members (Tables 1 and 2), it can be seen that although the HUM-Humanities groups are in the majority, the average number of members is deficient: 1.7 researchers per group is the lowest average of all the macro fields. This is because some groups (less than 5%) only provide information on the principal investigator, who is the only member of the group. Neither the website of the university to which the group belongs nor the ARP provides further data, and in many cases, it was not possible to find this information. Most of these groups correspond to the University of Malaga. The opposite is the case for ICT - Information and Communication Technology groups, where the average number of members per group is 13.5. In general, the average number of researchers per group is 9.9. In STEM, women represent 40.06% of all researchers and men 59.94%.

Table 2. Group members by gender

Macro-area of knowledge	Women	Men
HUM - Humanities	3930	4180
SEJ – Economic, Social and Legal Sciences	2118	2450
CTS – Health Sciences and Techniques	1516	1551
FQM – Physics, Chemistry, and Mathematics	1003	1617
RNM – Natural Resources and Environment	744	1069
TEP – Production Technology	537	1265
BIO – Biology and Biotechnology	779	746
ICT – Information and Communications Technology	415	1349
AGR – Agri-Food	524	651
Total	11566	14878

As regards the management of these 2445 groups, the majority are managed by male researchers, who account for 70.14%, compared with female researchers, who manage only 29.86% of the groups as shown in Table 3. The average representativeness percentage can be observed in the totals row of percentage columns. In the TEP - Production Engineering and ICT - Information and Communication Technology macro-areas, the proportion of female leaders is minimal, not even reaching 20%. The highest proportion of women leading their research groups is in HUM - Humanities (37%). In fields classified as STEM, only 24.19% of groups are led by women, compared to 75.81% of groups led by men. In non-STEM fields, however, women lead 36.23% of research groups.

When distinguishing between universities, it can be seen that none of the public universities in Andalusia have a majority of women in charge of research groups. The university with the highest percentage of groups led by women is the University of Almeria, where it reaches 37.85%. On the contrary, the university with the lowest representation of women is the University of Granada, with less than 25% as shown in Table 4.

Table 3. Gender of principal investigators by macro-area

Macro-area of knowledge	Principal investigator			
	Women	Percentage	Men	Percentage
HUM – Humanities	259	37.00	441	63.00
SEJ – Economic, Social and Legal Sciences	158	35.03	293	64.97
CTS – Health Sciences and Techniques	89	27.13	239	72.87
FQM – Physics, Chemistry, and Mathematics	54	22.22	189	77.78
RNM – Natural Resources and Environment	42	22.22	147	77.78
TEP – Production Technology	30	19.48	124	80.52
BIO – Biology and Biotechnology	40	28.37	101	71.63
ICT – Information and Communications Technology	24	18.05	109	81.95
AGR – Agri-food	34	32.08	72	67.92
Total	730	29.86	1715	70.14

Table 4. Gender of principal investigators by universities

University	Women	Percentage	Men	Percentage
Universidad de Almería	56	37.84	92	62.16
Universidad de Cádiz	59	30.26	136	69.74
Universidad de Córdoba	72	31.30	158	68.70
Universidad de Granada	131	24.62	401	75.38
Universidad de Huelva	27	28.13	69	71.88
Universidad de Jaén	35	28,23	89	71.77
Universidad de Málaga	97	29.48	232	70.52
Universidad de Sevilla	196	32.56	406	67.44
Universidad Pablo de Olavide	57	30.16	132	69.84
Total	730	29.64	1715	69.63

4. CONCLUSION

The results found that the average number of research groups in the nine universities with ARP groups is 271.7. However, women are only slightly in the majority in the macro-area BIO- Biology and Biotechnology (51.12%). The most significant differences to the detriment of women are in ICT-information and communication technology and PET-production technology (29.8% and 23.5%, respectively). These figures speak for themselves about the existence of horizontal discrimination against women in the research groups of Andalusian universities. These differences are even more remarkable when the representation of women among principal investigators is analyzed. Women lead less than 30% of research groups. Women are consistently underrepresented when looking more closely at these figures, both in the study of macro fields and in the study of universities. In the first case, the percentages range from 18% in ICT - information and communication technologies to 37% in HUM - humanities. In the study of universities, the representation varies between 25% of the University of Granada and 38% of the University of Almería. As for the tasks of responsibility in the direction and management of research groups, women are once again marginalized due to their low representation. They are only responsible for almost a third of the groups, which is a sign of the bias towards women as principal investigators. It translates into vertical discrimination against women in the distribution of positions of responsibility in the research groups. The low representation of women in the management of research groups also has repercussions on the accreditation processes for Spanish university professorships because the National Agency for Quality Assessment and Accreditation (NAQAA) rates the performance of these positions favorably. On the other hand, the heads of research groups are generally responsible for submitting applications for research project grants in public calls for

proposals. Therefore, in this aspect, too, women have fewer opportunities to lead research projects. These aspects help to perpetuate the glass ceiling that women suffer in this and other areas.

Among the limitations of the study, it should be noted that in many cases, the public information provided by the universities is not up to date, so no immediate notification is provided of terminations or new additions to the groups. In the data collection process, it was found that, in some cases, researchers who had retired or even died were still recognized. Furthermore, certain obscurantism has been observed in some universities concerning the people who comprise the research groups. They only seem to give information about the person in charge of the group. For this reason, the research management services of each university should promote measures to ensure that this information is kept up to date.

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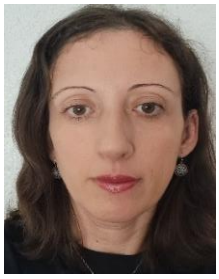
BIOGRAPHIES OF AUTHORS



María José Rodríguez-Baiget is a PhD student at the University of Córdoba. She has a degree in English-Italian translation and interpretation, and a Master's degree in English for professional qualification. Her research interests include the role of women in STEM areas in the management of Andalusian universities. She can be contacted at the following email: mariabaiget619@gmail.com.

Alexander Maz Machado is professor in the Department of Mathematics of the University of Córdoba (UCO). He completed his PhD in Mathematics Education in the University of Granada. His research interests are History of Mathematics and Mathematical Education; Bibliometrics; Scientometrics, attitudes towards mathematics, curriculum analysis in higher education and Women and science. He is a director of the research group "Mathematics, Education and Society" SEJ-589 of the Andalusian Research Plan PAIDI since 2016. Currently is the editor of Epsilon, Journal of Mathematical Education, edited by the Thales Society since 2010 and Mathematics, Education and Society (MES) since 2018. He can be contacted at email: ma1mamaa@uco.es.

José Carlos Casas del Rosal is an assistant professor in the mathematics department and previously in the statistics department. He has a BA in Mathematics and a Master's in Applied Statistics. His lines of research are the didactics of statistics, the analysis of statistical critical thinking, and studies on gender equality in work contexts, especially tourism, and research. He has published many articles and book chapters in prestigious journals and editorials. He can be contacted via email: jcasas@uco.es.

Arnaldo Vergara-Romero is an Associate Professor at the Faculty of Economic Business Sciences. He is also a Researcher at the Center for Sustainable Development at Ecotec University, leading research projects that address the economy and education. The led projects end up in public policies that transform the areas most impacted by the problem of poverty and extreme poverty. The research interest is economic development focused on education, technical training, and higher education. The email for contact is avergarar@ecotec.edu.ec.