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INTEGRATING A GENDER PERSPECTIVE INTO QUANTITATIVE RESEARCH: DEVELOPMENT OF A QUESTIONNAIRE ON SCIENTIFIC MYTHS IN HIGHER EDUCATION

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Integrating a Gender Perspective into Quantitative Research: Development of a Questionnaire on Scientific Myths in Higher Education

Miriam COMET-DONOSO[1]

Abstract

This study explores how gender perspective can be integrated into quantitative research through the development and validation of a questionnaire on scientific myths. The instrument was designed to identify scientific beliefs related to gender, race, and class among university students and to reveal how these beliefs may reproduce social inequalities in scientific and educational contexts. Using a participatory and reflexive process, the research combined theoretical review, expert validation, and pilot testing with students from the University of Barcelona. The findings confirmed the instrument's consistency and its relevance as a tool for analyzing epistemic biases in higher education. Beyond its methodological contribution, the study highlights the value of feminist approaches in promoting inclusive and socially responsible research practices. The questionnaire provides educators and researchers with a practical resource for addressing stereotypes and advancing equality within academic environments.

Keywords: gender perspective; quantitative research; scientific myths; higher education; social inequalities.

Introduction

This article presents the development and validation of a questionnaire on scientific myths from a gender perspective, designed for undergraduate students at the University of Barcelona, specifically from the Faculties of Education and Physics. The study is grounded in the need to understand how gender, racial, and class biases persist in scientific knowledge and educational practices, and how these beliefs continue to shape perceptions of legitimacy and authority in science.

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The paper is structured into four main sections. The first outlines the theoretical framework on scientific myths and the gender perspective informing the instrument's design. The second describes the content validation process conducted by expert judges. The third section details the pilot testing procedure, the analysis of the instrument's reliability, and how these steps informed the development of the final version of the questionnaire. Finally, the article presents the characteristics of the definitive questionnaire and discusses the specific considerations adopted to integrate a gender perspective throughout the process.

The study concludes by highlighting the main findings and implications derived from the development and validation process. Overall, this research seeks to contribute to the growing body of feminist and decolonial scholarship that challenges the neutrality of science, bringing attention to the cultural and political dimensions embedded in knowledge production.

Theoretical Background

Scientific Myths

Scientific myths are narratives that appear to have a scientific basis yet lack methodological rigor, often perpetuating sexism, racism, and classism. Although their existence in the scientific field might seem paradoxical, the presence of mythical elements within scientific discourse is a well-documented phenomenon (Keller, 1985). Myths act as symbolic frameworks through which societies interpret reality, and through which ideology is both expressed and reproduced (Midgley, 2003). Far from being mere misconceptions, they perform a powerful social function: legitimizing hierarchies and sustaining systems of inequality.

The persistence of these myths reveals that scientific discourse is not immune to ideology. As Noguera (2020) notes, myths shape how knowledge is produced and who is entitled to produce it. From the seventeenth century to the present, scientific myths have evolved alongside changes in social order, adapting to new contexts while maintaining their core function: the justification of dominance (Thapar, 2020). In contemporary society, the rapid spread of misinformation through social media has magnified this phenomenon. Vosoughi *et al*. (2018) found that false information circulates more quickly than verified facts, mainly due to cognitive and social mechanisms rather than technological ones.

Several hypotheses explain why such beliefs spread and persist:

- Simplification in a complex world. Myths provide comfort and order amid uncertainty (Hernando, 2012; Midgley, 2013). While pattern recognition is a basic cognitive mechanism, ideologically driven patterns can distort understanding and reinforce discrimination (Noguera, 2020).

- Cognitive dissonance. People tend to maintain beliefs that align with dominant social systems, reducing internal tension when faced with contradictions (Tavris & Aronson, 2007; Rippon, 2019).
- Predictive coding. The brain anticipates patterns consistent with social hierarchies, making domination appear natural (Rippon, 2019).
- Constant re-elaboration. Myths are reinterpreted across generations to fit new realities, blurring the boundary between history and fiction (Thapar, 2020).
- Confirmation bias. Individuals selectively attend to information that supports their preconceptions, which explains the persistence of pseudo-scientific ideas even after being empirically refuted (Noguera, 2020).

These dynamics reveal how myths are not only epistemological distortions but also mechanisms of social control. For instance, biological determinism has long been used to reinforce gender stereotypes and resist change (Brescoll & LaFrance, 2004; Rippon, 2019). The persistent notion of male and female brain dimorphism, often invoked to justify intellectual differences, continues to circulate despite robust neuroscientific evidence refuting it (Fausto-Sterling, 2006; Ruigrok *et al*., 2014; Holloway, 2017). Similarly, racial myths such as the "multiregional theory of human evolution," discredited by Porr and Matthews (2017), have historically been used to naturalize hierarchies between populations.

Understanding how these myths operate is particularly relevant in higher education, where future professionals form their epistemological and ethical frameworks. Universities are spaces where knowledge is both produced and legitimized; thus, identifying students' beliefs and perceptions about science is crucial to reveal hidden biases (Couso *et al*., 2020). Addressing scientific myths provides tools to design pedagogical strategies that promote inclusion, diversity, and equity, thereby contributing to the construction of socially just educational communities.

Quantitative Research and the Gender Perspective

When this article refers to gender perspective, it is understood within the framework proposed by Jiménez-Cortés (2021), which conceives gender as inseparable from other axes of inequality such as race and class. Gender, race, and class are not separate analytical dimensions but interrelated categories that shape the production and interpretation of knowledge. Recognizing this interconnection reveals power dynamics that traditional research often overlooks and fosters transparency in methodological decision-making.

Quantitative research has traditionally been viewed as incompatible with feminist epistemology or gender perspective because of its association with neutrality and objectivity. However, since Peplau and Conrad's seminal work (1989, cited in Hesse-Biber, 2011), scholars have demonstrated that quantitative

methods can indeed serve feminist inquiry when applied reflexively. Gender-sensitive quantitative research enables: (1) reaching broader and more diverse populations to disseminate equality-oriented discourses; (2) using statistical evidence to strengthen arguments for social equity; (3) capturing a wide range of experiences through systematic measurement; and; (4) increasing the public credibility of research addressing gender and social justice.

In this study, a survey-based design was adopted, using a questionnaire as the principal instrument. This approach is well suited to educational contexts because it allows the efficient collection of comparable data while encouraging self-reflection among participants (Folgueiras-Bertomeu, 2018). Importantly, from a gender perspective, the questionnaire is not merely a measurement tool but a site of epistemological negotiation, where categories are constructed, questioned, and redefined.

Two main traditions of integrating gender in quantitative research can be identified. The first focuses on the data analysis phase, incorporating procedures that reduce bias and ensure gender-sensitive interpretation (Hesse-Biber, 2011). The second advocates for embedding feminist/gender principles throughout the entire process, from conceptualization to interpretation, thus ensuring coherence between epistemology and methodology (Biglia & Vergés, 2016; Jiménez-Cortés, 2021). This study follows the latter approach, engaging in critical reflection at every stage to maintain alignment between theoretical positioning and methodological design.

Ultimately, quantitative methods are not inherently objective or neutral (Biglia *et al*., 2022). When approached through a gender lens, they become powerful tools for questioning scientific assumptions, exposing bias, and promoting equitable practices. The present research therefore contributes to ongoing efforts to demonstrate that methodological rigor and ethics are not incompatible but mutually reinforcing in the pursuit of social transformation.

Methodology

Objectives of the Study

The general objective is to develop and validate a questionnaire that identifies beliefs and perceptions related to scientific myths, particularly those involving gender, racial, and class biases, among university students.

The specific objectives of the questionnaire are to: (1) Examine who is perceived as a legitimate subject within the scientific field; (2) Analyze gender perceptions and biases embedded in scientific discourse; (3) Explore beliefs related to racism and other social inequalities within science.

Research Design

This study followed an instrumental design (Ato, López, & Benavente, 2013) aimed at developing and validating a questionnaire to explore scientific myths from a gender perspective. The approach combined methodological rigor with a social commitment to equality, integrating participatory and reflexive practices at every stage of the research.

This design is particularly suitable for constructing tools that measure latent social and educational constructs while ensuring both validity and reliability. The methodological process was conceived not only as a technical procedure but as an epistemic practice aligned with gender-aware principles of collaboration, inclusion, and critical reflexivity.

Participants

The research was conducted with a pilot sample of 105 undergraduate students from the University of Barcelona (56 from the Faculty of Education, 41 from the Faculty of Physics, and 8 excluded due to incomplete responses). These two faculties were intentionally selected to represent contrasting epistemological traditions, the social sciences and the experimental sciences, thus enabling a comparative analysis of how scientific myths operate across academic contexts.

Participants were recruited through convenience sampling, based on the institutional accessibility of the research team. This diversity of disciplinary backgrounds allowed the study to examine how beliefs related to gender, race, and class may manifest differently depending on disciplinary culture and academic training.

All participants took part voluntarily and were informed about the aims, conditions, and confidentiality of the study. The research adhered to the ethical principles of voluntary participation, anonymity, and informed consent, following the guidelines of the University of Barcelona's ethics framework for educational and social research.

Instrument Development

The questionnaire was constructed through three interconnected phases; deductive, inductive, and participatory (Folgueiras-Bertomeu & Sabariego, 2015), following gender-aware principles of collaboration, reflexivity, and inclusion.

Deductive Phase: A systematic review of feminist and decolonial literature on scientific myths guided the conceptual framework (Haraway, 1988; Schiebinger, 2001). This analysis identified three main dimensions of belief systems related to inequality: (1) Legitimate Subject: who is recognized as a valid producer of knowledge (Harding, 1993; Fricker, 2007); (2) Gender: myths that attribute innate

differences between identities (Rippon, 2019; Saini, 2017); (3) Racism: pseudo-scientific narratives that justify social hierarchies (Saini, 2020).

Inductive Phase: Drawing on the researchers' teaching and training experience in gender and science studies, items were iteratively rephrased to ensure clarity, accessibility, and cultural relevance (Hooks, 1994). This process made it possible to adapt the language to students from diverse academic and social backgrounds, enhancing contextual validity.

Participatory Phase: Five external collaborators, academics and activists specializing in gender, science, and LGBTQ+ issues, were engaged in refining the questionnaire (Donoso-Vázquez & Velasco-Martínez, 2013). Through two rounds of group discussion, the team clarified terminology, simplified response scales, and reviewed historical and social examples to avoid bias.

This dialogue between academic and activist knowledge strengthened the instrument's social sensitivity and inclusiveness, ensuring that the design process embodied feminist values of cooperation, transparency, and epistemic justice.

Content Validity

To assess content validity, seven experts in gender studies, research methodology, and social diversity reviewed the instrument following the criteria proposed by Escobar-Pérez & Cuervo (2008) and Corral (2009). Experts were selected based on their experience in feminist epistemology, educational research, and diversity training. Each expert rated the items according to clarity, relevance, and pertinence, using a three-point ordinal scale (1–3), and provided qualitative feedback to refine item wording and conceptual coherence.

This process resulted in the consolidation of three core dimensions, legitimate subject, gender, and racism, and the removal of redundant items (see Table 1). The validation stage was conceived not merely as a technical procedure but as an epistemic dialogue grounded in participatory and gender-sensitive principles, reflecting an ethical commitment to openness, inclusion, and the collective construction of knowledge. This approach contributes to developing socially responsible and transformative research tools within the fields of education and social sciences (Araiza Díaz, 2020; Jiménez-Cortés, 2021).

Table 1. Summary of changes made after validation by expert judges

Initial Questionnaire	Changes After Validation by Expert Judges
Epistemological Dimension (Questions 1–4)	Changed to Legitimate Subject Dimension (Questions 1–6)
Social Dimension (Question 5)	Removed and incorporated into the Legitimate Subject Dimension
Pseudosciences Dimension (Question 6)	Removed
Gender Dimension (Questions 7–10)	Gender Dimension (Questions 7–9)
Sex–Gender Dimension (Question 11)	Removed
Essentialist Motherhood Dimension (Question 12)	Removed
Racial Dimension (Question 13)	Racial Dimension (Questions 10 and 11)
Sociodemographic Data	Sociodemographic data
Age	No changes
Gender	Option added to self-identify gender identity
Sex	No changes
Parents' education	Three parental education options added
Previous educational institution	Option added: Religious school
Undergraduate studies	No changes
Belonging to the LGTBIQ+ community	No changes
LGTBIQ+ perception	No changes
Considering oneself racialized	Definition of "racialized person" added
Participation in the LGBTIQ+ movement	No changes
Perception and political participation in anti-racism and feminism	No changes

Source: prepared by the author

Results

Overview of the Pilot Study

The pilot study was conducted to assess the reliability and internal consistency of the questionnaire, as well as to ensure that its items were comprehensible, relevant, and coherent with gender framework guiding the research. The pilot also served to evaluate how the instrument performed across students from distinct academic disciplines, education and physics, representing different epistemological traditions.

The online survey remained open for one month. Participants were fully informed of the aims and procedures of the study, provided voluntary consent, and were assured of anonymity and confidentiality.

The analysis was based on the responses obtained in the pilot study, which included participants from both the social and natural sciences, allowing for comparison across disciplinary contexts. Sociodemographic characteristics of the sample were as follows:

– Gender: 67.6% women, 22.8% men, 2.8% non-binary, and 3.8% no response.
– Place of birth: 86.6% from Catalonia/Spain, 8.6% from other countries.
– Sex assigned at birth: 69.5% female, 22.8% male, 1.9% no response.
– Self-perceived social class: 52.4% middle class, 21.0% working class, 11.4% lower class, 2.8% upper class.
– Race: 82.8% non-racialized, 7.6% self-identified as racialized, with the remainder unsure or non-responsive.

This diversity provided a valuable picture of the student population and allowed for the exploration of how social positioning, by gender, class, and racialization, might influence perceptions about science. Importantly, the heterogeneity of the sample also enabled the research team to observe how gender-sensitive methodological principles operate when applied to a quantitative context.

Reliability Analysis

Reliability was assessed using Cronbach's alpha, a coefficient widely used in the social sciences to estimate the internal consistency among items that measure a shared construct (AERA, APA, & NCME, 2014; Field, Miles, & Field, 2012). Although Cronbach's alpha is not a perfect indicator of reliability, it remains useful in exploratory studies to identify weak items, check homogeneity, and support qualitative judgments made during earlier validation rounds.

The statistical analyses were carried out using IBM SPSS Statistics (version 28) to compute item–total correlations and Cronbach's alpha coefficients. Each item

was reviewed for conceptual clarity and consistency with its theoretical dimension, and minor adjustments were introduced to enhance interpretability and reliability.

The results were satisfactory across all three dimensions, with alpha values exceeding 0.75, confirming strong internal consistency and internal coherence of the questionnaire (see Table 2).

Table 2. Results of the Reliability analysis

Dimensions	Number of questions	Number of items	Corrected homogeneity index	Cronbach's alpha
Legitimate Subject Dimension	6	27	0,756	0,759
Gender Dimension	3	43	0,964	0,964
Racism Dimension	2	12	0,898	0,901

Source: prepared by the author

These values indicate that the items within each scale coherently measured the intended constructs and that the instrument effectively captures stable patterns of beliefs and representations about scientific myths among university students.

Beyond numerical evidence, the reliability analysis was also conceived as a reflective exercise on how research tools can reproduce or challenge bias. The integration of quantitative evaluation with qualitative feedback ensured that the questionnaire was not only technically robust but also socially responsive and epistemologically coherent with its gender-aware framework.

Following the statistical analysis and expert feedback, a series of refinements were applied to strengthen clarity and inclusiveness. Key adjustments included: (1) Simplifying the question on caregivers' educational level to avoid redundant detail; (2) Distinguishing items about self-perception from those on political participation in feminist or anti-racist actions; (3) Clarifying potentially ambiguous terms such as *innate* and *biological*, which may carry ideological implications; (4) Revising absolute expressions ("always," "never") to avoid oversimplified interpretations; (5) Redefining social class categories to prevent implicit hierarchies (for example, to prevent associations such as identifying the working class as synonymous with the lower class).

Characteristics of the Final Instrument

The final questionnaire was designed in accordance with the criteria proposed by Ruiz-Bueno (2009) for high-quality social science instruments: (1) use of accessible and inclusive language; (2) limitation of each question to a single,

clear idea; (3) attention to precision and coherence; (4) collection of essential information only; and (5) use of a direct and personal style.

Additionally, a balance between positively and negatively phrased items was maintained (Palou, 2014) to minimize response bias and promote reflexivity among participants.

Table 3 presents an overview of the final questionnaire, summarizing each item according to its type (open-ended, scalar, or multiple-choice) and its specific function within the instrument.

The instrument was originally developed and administered in Catalan, with Spanish and English translations for dissemination. It is freely available through the University of Barcelona's institutional repository https://hdl.handle.net/2445/207614.

Table 3. Question types per item

Question	Type of question and function
1	Scale. Opinion on the legitimate subject of science.
2	Scale. Opinion on the legitimate subject of science.
3	Scale. Opinion on scientific talent.
4	Closed-ended with list of alternatives (YES, NO, DK/NR). Opinion on the presence of men or women in different areas of knowledge.
5	Closed-ended with list of alternatives (A LOT, QUITE A LOT, MODERATE, LITTLE, NONE). Opinion on the degree of scientific talent in different areas of knowledge.
6	Scale. Opinion on scientific activity.
7	Scale. Opinion on hormones.
8	Scale. Opinion on the brain.
9	Scale. Opinion on masculinity and femininity.
10	Scale. Opinion on scientific racism.
11	Scale. Opinion on scientific racism.
Identification	Set of 13 questions: 1 open-ended, 12 closed ended.

Source: prepared by the author

Incorporation of the Gender Perspective

The integration of gender-equal principles was articulated through a, three-level approach, theoretical, methodological, and instrumental, ensuring coherence across all phases of design and validation.

– Theoretical Level: Feminist and decolonial epistemologies were explicitly incorporated to question the presumed neutrality of science and highlight how gender, race, and class shape both research and education (Araiza Díaz, 2020; Jiménez-Cortés, 2021).

– Methodological Level: The process included collaboration with activists and non-academic experts in gender, science, and sexual diversity (Donoso-Vázquez & Velasco-Martínez, 2013), whose participation helped avoid external or Eurocentric impositions and ensured contextual sensitivity.

– Instrumental Level: Each item was reviewed to ensure inclusive and non-sexist language, open self-identification options, and conceptual explanations that foster critical understanding.

Beyond these structural levels, the integration of the gender perspective also materialized in the wording and sequencing of the items. For instance:

– Gender-neutral and plural forms (e.g., *people*) replaced generic masculine nouns.

– Non-binary and intersex identities were explicitly included when relevant, with definitions provided for key terms such as *cis* and *intersex* to ensure clarity.

– The phrase *"none of the above describes me; I define myself as…"* replaced *"other"*, preventing marginalization of non-normative identities.

– The concept of "current gender" was added to capture the fluid and dynamic nature of gender identity.

– Family-related questions used the neutral term *caregivers* to acknowledge diverse family structures.

– In addressing race and class, the term *racialized persons* was introduced as a social category linked to systemic discrimination, avoiding the assumption of whiteness as the default.

The questionnaire also distinguishes between three analytical levels, self-perception, action, and implicit beliefs, applied to feminist, anti-racist, and LGTBIQ+ dimensions. This allows for a multidimensional understanding of participants' perspectives, capturing both declared positions and unconscious assumptions about equality and power relations.

Overall, the pilot study and its subsequent refinement processes demonstrate that feminist/gender-sensitive principles can be successfully embedded in quantitative research design. The resulting questionnaire is not merely a measurement instrument but also a pedagogical and critical tool that fosters reflection among participants and supports the development of more equitable academic environments.

Discussion

The findings demonstrate that integrating gender perspective into quantitative methodology strengthens both the validity and the social relevance of research tools.

Scientific myths, when presented as objective knowledge, contribute to reinforcing symbolic hierarchies related to gender, race, and class (Keller, 1985; Rippon, 2019; Saini, 2017). Within higher education, such narratives shape how students and faculty understand scientific legitimacy and who is perceived as a credible producer of knowledge (Harding, 1993; Fricker, 2007). By challenging these assumptions, this study situates itself within current efforts to promote epistemic justice and the democratization of knowledge production.

This research provides a structured and replicable framework for developing instruments that enable the analysis of how pseudo-scientific beliefs circulate in academic contexts. gender-sensitive approach of the design ensured reflexivity throughout the process, acknowledging participants as co-constructors of knowledge and emphasizing inclusivity, transparency, and ethical accountability (Hesse-Biber, 2011; Jiménez-Cortés, 2021). The collaboration with experts and activists reinforced the connection between academic research and social action, bridging theoretical analysis and practical intervention. This participatory approach aligns with gender research traditions that understand methodology not merely as a set of techniques, but as a political stance that affects the distribution of voice and power in the production of knowledge.

Beyond its psychometric validation, the design process invited a deeper reflection on the ethical and pedagogical responsibilities of researchers in social sciences. Quantitative instruments often claim neutrality, yet they inevitably shape what can be seen and said about the social world (Biglia *et al*., 2022). This project demonstrates that by applying gender lens, measurement itself can become an act of critique and reconstruction. The questionnaire, therefore, functions not only as a measurement tool but also as a pedagogical and transformative resource capable of promoting critical awareness among students, educators, and researchers (Folgueiras-Bertomeu, 2018). It invites users to reconsider how categories such as gender, race, and class operate in academic knowledge, and to use data as a medium for self-reflection and collective learning.

Educational and Social Implications

The instrument developed in this study can be used by educators, researchers, and policymakers to identify and challenge implicit biases that persist in academic and scientific environments. Its structure allows for diagnosis, dialogue, and intervention, providing empirical evidence that can guide institutional strategies toward gender equality, intercultural competence, and inclusive education. Within

university settings, it can serve as a basis for curriculum design, professional training, and the evaluation of equality policies.

More broadly, this work contributes to the field of social intervention by demonstrating that research instruments can embody ethical and political commitments without losing scientific rigor. In this sense, the study echoes call from critical pedagogy and gender science studies to bridge empirical research with transformative educational practices. The availability of the questionnaire in three languages (Catalan, Spanish, and English) also enhances its potential for cross-cultural adaptation and comparative analysis, encouraging collaborative projects within and beyond European contexts.

Limitations and Future Directions

While the pilot study confirmed the internal consistency and conceptual coherence of the instrument, its relatively small and localized sample limits the generalizability of the findings. Further research should apply the questionnaire to larger and more diverse populations, particularly in other universities and disciplines, to validate its construct structure and explore potential variations across sociocultural contexts. Complementary psychometric analyses, such as confirmatory factor analysis or test–retest reliability, would provide additional evidence of robustness.

At the same time, qualitative follow-up studies could explore how students interpret the questionnaire items and how their responses reflect broader cultural narratives about science, merit, and difference. These mixed-method approaches would help deepen understanding of the interplay between epistemic beliefs and social positioning. Finally, longitudinal applications could assess how exposure to critical pedagogies influences students' perceptions of scientific myths over time.

Conclusion

The study presents a validated, accessible, and socially engaged instrument for examining how scientific myths perpetuate inequality in higher education. By embedding gender-equal principles into quantitative research, it challenges the notion of scientific neutrality and demonstrates that empirical tools can serve as instruments of reflection, critique, and empowerment.

Ultimately, this research underscores that methodological rigor and social commitment are not opposing goals but complementary pillars of transformative social science. It contributes to consolidating a line of inquiry that views education and research as intertwined practices aimed at equality, epistemic pluralism, and social justice. In doing so, it reaffirms the potential of gender-sensitive quantitative methodologies to produce knowledge that is not only valid and reliable, but also ethically grounded and socially transformative.

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