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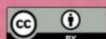
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ANA MAIA FERNANDES, SOFIA CARDIM

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ANA MAIA FERNANDES¹

SOFIA CARDIM²

¹ University of Beira Interior; Covilhã; Portugal & CIEQV, Polytechnic Institute of Santarém; Portugal; <https://orcid.org/0000-0002-1448-4419>; ana.fernandes@ese.ipsantarém.pt

² Instituto Politécnico de Bragança; Portugal; <https://orcid.org/0000-0002-7506-5111>; sofiacardim@ipb.pt

Contribution

¹ Conceptualization; Data Curation; Formal Analysis; Investigation; Methodology; Writing - Original Draft.

² Conceptualization; Investigation; Writing - Review & Editing.

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ABSTRACT: Gender stereotypes related to science and scientists continue to shape students' perceptions from an early age, contributing to persistent gender inequalities in STEM fields. This exploratory study examines how lower secondary school students in Portugal portray scientists, with a particular focus on gendered patterns. Conducted during the first week of the 2024/2025 school year, the study involved 28 eighth-grade students. It employed the Draw-A-Scientist Test Checklist (DAST-C), using a quantitative approach complemented by interpretative qualitative elements. As this is an exploratory study, it does not aim to draw generalisable conclusions, but rather to identify indicative patterns and generate information for future research. Quantitative and qualitative analyses reveal a strong persistence of stereotypical representations, particularly masculine traits such as lab coats, glasses, and facial hair. At the same time, female scientists remain markedly underrepresented and are depicted exclusively by female students. These findings highlight the continued influence of gendered imaginaries during early adolescence and underline the role of schools as critical spaces for challenging stereotypes and promoting more inclusive representations of science.

KEYWORDS: Science; representation of scientists; gender; stereotype; DAST-C.

RESUMO: Os estereótipos de género relacionados com a ciência e os cientistas continuam a moldar as perceções de estudantes desde tenra idade, contribuindo para a persistência das desigualdades de género nas áreas STEM. Este estudo exploratório examina como estudantes do ensino básico em Portugal retratam cientistas, com especial destaque para os padrões de género. Realizado durante

a primeira semana do ano letivo de 2024/2025, o estudo envolveu 28 alunos do 8.º ano e utilizou o Questionário *Draw-A-Scientist Test Checklist* (DAST-C), utilizando uma abordagem quantitativa complementada por elementos qualitativos interpretativos. Por se tratar de um desenho exploratório, o estudo não visa chegar a conclusões generalizáveis, mas sim identificar padrões indicativos e gerar informações para investigações futuras. Análises quantitativas e qualitativas revelam uma forte persistência de representações estereotipadas, particularmente de traços masculinos, como batas de laboratório, óculos e barba, enquanto as cientistas femininas continuam a ser marcadamente sub-representadas e são retratadas exclusivamente por estudantes do sexo feminino. Estas conclusões destacam a influência contínua dos imaginários de género durante o início da adolescência e sublinham o papel das escolas como espaços críticos para desafiar estereótipos e promover representações mais inclusivas da ciência.

PALAVRAS-CHAVE: Ciência; representação de cientistas; género; estereótipo; DAST-C.

RESUMEN: Los estereotipos de género relacionados con la ciencia y los científicos siguen moldeando las percepciones de los estudiantes desde una edad temprana, lo que contribuye a la persistencia de las desigualdades de género en los campos STEM. Este estudio exploratorio examina cómo los estudiantes de enseñanza básica de Portugal retratan a los científicos, con especial atención a los patrones de género. Realizado durante la primera semana del año escolar 2024/2025, el estudio contó con la participación de 28 estudiantes de octavo grado y utilizó la lista de verificación de la prueba «Dibuja a un científico» (DAST-C), utilizando un enfoque cuantitativo complementado con elementos cualitativos interpretativos. Al tratarse de un diseño exploratorio, el estudio no pretende llegar a conclusiones generalizables, sino identificar patrones indicativos y generar información para futuras investigaciones. Los análisis cuantitativos y cualitativos revelan una fuerte persistencia de las representaciones estereotipadas, en particular de rasgos masculinos como batas de laboratorio, gafas y vello facial, mientras que las científicas siguen estando notablemente infrarrepresentadas y son retratadas exclusivamente por alumnas. Estos resultados ponen de relieve la influencia continua de los imaginarios de género durante la adolescencia temprana y subrayan el papel de las escuelas como espacios críticos para cuestionar los estereotipos y promover representaciones más inclusivas de la ciencia.

PALABRAS CLAVE: Ciencia; representación de científicos; género; estereotipo; DAST-C.

1. Introduction

Despite the progress achieved in recent decades through gender equality policies and educational initiatives, gender disparities persist as a significant feature of participation in Science, Technology, Engineering, and Mathematics (STEM). Women remain underrepresented across several scientific fields, particularly in physics, engineering, and computing. This imbalance cannot be adequately explained by differences in academic performance or cognitive ability, leading researchers to increasingly emphasise the role of sociocultural factors in shaping educational pathways.

Among these factors, gender stereotypes play a central role. Stereotypical representations of science and scientists are constructed and transmitted through everyday social experiences, including family interactions, schooling, media, and visual culture. Scientists are frequently portrayed as male figures, socially distant and engaged in laboratory-based or potentially dangerous activities. Such images contribute to the perception of science as a field associated with specific

personal traits and identities, which may influence students' motivation, self-confidence, and sense of belonging. For many girls, these representations can create a perception of science as misaligned with their own identity, discouraging sustained engagement.

Educational contexts are particularly relevant in this process. Schools function as key spaces of socialisation, where representations of science and scientists are both reinforced and, potentially, questioned. From an early age, students begin to form mental images of who scientists are and what scientific work involves. These images tend to become more stable during adolescence, a developmental stage marked by increased identity awareness and reflection about future academic and professional choices. Visual representations, including students' drawings, offer valuable insights into these implicit conceptions, revealing beliefs that may not be easily captured through verbal or written responses. Within this perspective, visual methodologies such as the Draw-A-Scientist Test (DAST) provide a structured approach to accessing these representations, allowing researchers to analyse how students conceptualise scientists systematically.

In this context, students' representations of scientists can be understood as a key mechanism through which gender stereotypes are internalised and reproduced, making them a relevant analytical entry point for examining how such inequalities are constructed in educational settings.

Although students' representations of scientists have been widely studied using visual methodologies such as the Draw-A-Scientist Test (DAST), existing research has largely focused on early childhood and primary education. In contrast, early adolescence, corresponding in Portugal to the 3rd cycle of basic education, has received comparatively less attention, despite its importance in shaping long-term educational trajectories. This gap is particularly evident in the Portuguese context.

In response to this gap, the present study examines how students in the 3rd cycle of basic education in Portugal represent scientists, with particular attention to gender-related patterns. Using the Draw-A-Scientist Test Checklist (DAST-C), the study analyses both quantitative and qualitative aspects of students' drawings to explore the persistence of stereotypical representations and the visibility of female scientists. By focusing on this educational stage, the research aims to contribute to a more nuanced understanding of how gender stereotypes related to science are constructed and maintained in school contexts, thereby informing educational practices that promote more inclusive representations of science. Considering the identified gap, this study addresses the following research questions: (1) What is the image of a scientist in the minds of 3rd Cycle students? and (2) What is the image of a female scientist in the minds of 3rd Cycle students?

2. Theoretical framework

2.1. Gender stereotypes and inequality in STEM education

Since the 1990s, gender inequality in education and the labour market has been recognised as a major obstacle to achieving global development goals, particularly in science-related fields. To address these problems and advance international development agendas, a strategy known as gender mainstreaming has been adopted (Kataeva et al., 2024). These advances have led to a growing number of initiatives promoting increased female participation in Science, Technology, Engineering, and Mathematics (STEM). The United Nations (United Nations Educational, Scientific and Cultural Organisation, 2021) has played a central role in promoting policies geared towards the Sustainable Development Goals (SDGs), setting clear targets for achieving gender equality and women's empowerment, both in terms of 'Quality Education' (SDG 4) and 'Gender Equality' (SDG 5). However, despite these efforts, women continue to be underrepresented in STEM fields compared to men.

According to the Global Gender Gap Report 2023, women represent only 29.2% of the workforce in STEM fields. In skills such as technological literacy, artificial intelligence and big data, gender parity remains below 50%¹. In Portugal, according to Eurostat data from 2022, women account for only 36.3% of professionals in STEM fields in the tertiary sector, a figure that has been declining since 2015, when it stood at 39.0%. This reality is marked by disparities between European countries, with proportions ranging from 51% in Turkey to 27.5% in Belgium².

There are cultural issues that persist across time and space, with harmful stereotypes that drive girls and young women away from science, particularly in STEM fields such as physics and computing (Allen, 2018). Women and girls face multiple obstacles in accessing training, recruitment, progression and retention in these areas, which is particularly worrying because salaries in STEM professions tend to be higher, thus perpetuating gender pay inequalities (Starr, 2018). A stereotype is a simplified, rigid generalisation about a social group, used to organise and understand reality quickly, but which often results in distorted and unfair interpretations (Tintori & Palomba, 2017). These are constructs influenced by various sociocultural factors that vary by nationality, social class, age, and other factors. These factors shape how people perceive certain groups. The most common gender stereotypes reflect a division between professions considered scientific, usually associated with men, and care-oriented professions, more often attributed to women. For example, it is commonly believed that men are more likely to become scientists or engineers, while women are seen as better suited to roles in care and education.

Gender stereotypes in science extend beyond the attribution of personal characteristics or professional roles. They also include the historical invisibility of women scientists, the under-recognition of their scientific contributions, and the limited presence of female role models in educational and cultural narratives. As a result, students may develop a view of science in which scientific achievement is predominantly associated with men, while women's contributions remain less visible or valued. These mechanisms contribute to the reproduction of gender inequalities and influence how young people imagine who can become a scientist.

Stereotypes about science and scientists convey social messages that influence who feels capable, or not, of working in this field. There are persistent stereotypes, such as the idea that 'women are not good at mathematics.' These stereotypes can affect female students' self-confidence and performance (Wyer et al., 2010). Given that stereotypes describe a 'type of person,' they can be an important element in identity construction and significantly influence the development of attitudes and strategies for success in STEM fields. When students do not identify with the traditional image of the scientist, often associated with white men, especially those from underrepresented groups, they may feel excluded and unmotivated. This lack of identification can negatively affect their performance and engagement with science. Most existing studies have been conducted in contexts with little diversity, making it urgent to investigate these issues in environments that welcome a large proportion of minority students.

Examining this issue upstream, although many factors contribute to gender inequalities in STEM fields, one of the primary causes of these differences is lower motivation and interest among girls, which often begins in childhood and later influences their academic career choices. This lack of interest is partly due to widespread cultural stereotypes that associate STEM fields with boys. Research suggests that there are two types of stereotypes: on the one hand, the stereotype of "cultural fit", i.e. the idea that "mathematics is a boy thing"; on the other, a "competence" stereotype, which conveys the belief that boys are naturally better than girls at solving problems. These early-formed stereotypes constitute a central backdrop for understanding how images of

¹ World Economic Forum (2023).

² Eurostat (2024).

science and scientists are constructed, transmitted and internalised through visual and cultural representations.

2.2. Visual culture, media representations and the construction of scientific identity

Visual teaching practices should incorporate gender perspectives to avoid reinforcing inequalities (Barromi-Perlman et al., 2021); visual symbolism plays a fundamental role in the construction of gender identity. Consciously or unconsciously, stereotypes are assimilated, reflecting the dominant values of a given society and culture. Visual symbols also have the power to naturalise constructs, perpetuating an abnormal normality. What is (or should be) feminine and what is (or should be) masculine is easily internalised by a child when they see a drawing of a man working as a policeman, firefighter or mechanic; or of a woman working as a nurse, teacher or nanny. Through images and their symbolism, the idea that men are associated with strength, robustness, and leadership is perpetuated, while women are associated with candour, fragility, and care for others. These visual and cultural representations can be understood as part of a broader gendered imaginary, defined as the socially constructed set of meanings, symbols, and expectations through which gender roles and identities are collectively perceived, normalised, and reproduced across contexts.

According to Tintori and Palomba (2017), the dominant image of scientists is that of a white, middle-aged man who is highly intelligent but socially inept (a geek or nerd), obsessed with work, and lacking a social or family life. This image is often inspired by the figure of the “mad scientist” in films and series, associated with isolation, genius, eccentricity and even a threat to society. However, some changes to this pattern have emerged in recent decades, with an increasing representation of female scientists among lower secondary school students, as well as young scientists, who are often dressed more casually, frequently without glasses or facial hair, and appear to work in isolation (Bozzato et al., 2021). These authors also note that in Western countries, boys tend to draw exclusively male scientists, while some girls represent female scientists. Girls also tend to represent more symbols of knowledge than their male counterparts.

Media representations of scientists, both men and women, can reflect cultural views and influence stereotypes by offering alternative and diverse models. Unattractive images of female scientists, as lonely heroines, can reinforce negative views about science and those who work in it, especially among girls and young women. The marginalisation and sexualisation of these characters in cinema contribute to the myth of female incompetence and the reproduction of social discrimination. Magazine profiles praised these women for their brilliant ability to balance their professional and domestic lives. Examples include Maria Mayer and Rosalyn Yalow, both Nobel Prize winners, who are admired for maintaining their femininity and dedication to their families while excelling in their scientific pursuits. This representation reinforced the image of women scientists as exceptions, almost anomalies in a male-dominated world.

Women were indeed a minority in this field. In the 1950s, less than 10% of doctorates in science and engineering in the US were awarded to women. Men were seen as “ordinary” scientists, fundamental to everyday science, while women were often relegated to subordinate roles as assistants or “super scientists”. The difficulties of balancing a personal life and a career were portrayed as an exclusively female dilemma, suggesting that being a scientist required extraordinary sacrifices. This stereotype also appeared in cinema: female scientists were either not ‘real women’ or lacked the masculine traits considered necessary for success in science (Mitchell & McKinnon, 2019). In this context, it is worth mentioning the example of the popular television series *The Big Bang Theory*, which depicts the daily lives of four young male nerds, physicists, and engineers.

According to Filipova (2017), the female characters in the series are represented stereotypically, oscillating between markedly feminine and excessively rational roles, with their interactions often mediated by their physical appearance. Such representations highlight how the media's influence can limit girls' interest and participation in STEM fields. Starr (2018) demonstrated that various stereotypes, particularly the notion that individuals working in STEM fields are nerds, can deter women from pursuing STEM careers because they conflict with societal expectations (such as being sociable, attractive, or having an active social life).

One aspect of gender inequality that has been addressed is the analysis of images in school textbooks across various subjects, and Portugal is no exception. However, despite the efforts made and the progress already achieved, which should be given due credit, stereotypical images still persist across various subjects and curricular areas, such as physics, where male images predominate. Beyond media and popular culture, schools also play a central role in reproducing or challenging gendered representations of science. In this sense, students' representations of scientists can be understood as a reflection of these broader visual and cultural influences, making their drawings a particularly valuable lens through which gendered imaginaries are internalised, reproduced, and potentially transformed.

2.3. Students' representations of scientists and the Draw-A-Scientist tradition

From pre-school onwards, students begin to form stereotypical perceptions of scientists, often seen as men, socially awkward, nerdy, and working alone. These gender stereotypes tend to persist and even intensify with age, possibly due to greater exposure to men in scientific fields than to women (Gormally & Inghram, 2021). The literature suggests that most students' contact with science occurs in the classroom, and that teachers play a significant role in shaping how students perceive it. The learning dynamics promoted in the classroom can contribute to maintaining or transforming the image that students form of science and those who practice it.

Several classic studies and instruments, such as those by Mead and Métraux (1957), the Draw-A-Scientist Test (DAST), the Image of Science and Scientists Scale (ISSS) and the Women in Science Scale (WiSS), have in common the fact that they all seek to understand how students perceive science and scientists. They all start from the premise that stereotypes influence how young students relate to scientific knowledge and the idea of being a scientist (Wyer et al., 2010). These qualitative methodologies can therefore be useful for exploring the range of students' ideas about stereotypes and for identifying unexpected responses that may not appear in more commonly used quantitative surveys (Schinske et al., 2015).

In Portugal, several published studies on this topic have applied the DAST methodology, conducted with students in the 1st and 2nd cycles of basic education, and more recently, a study conducted by Martins et al. (2023) with primary and secondary school students confirms the same result: most students represent a male scientist in the fields of engineering and technology, but not in mathematics.

Despite the consolidated literature on students' conceptions and stereotypes in the 1st and 2nd cycles of basic education, a notable gap persists regarding students in the 3rd cycle, particularly in the Portuguese context, where empirical studies focusing on early adolescence remain scarce. The literature reveals that the gender gap in STEM subjects is most pronounced among the 13- to 17-year-old age group, corresponding in Portugal to the beginning of the 3rd cycle of basic education³. Research in this age group is particularly important, as it precedes secondary education, a stage in which the gender gap in STEM subjects tends to become more pronounced, influencing

³ European Commission, Directorate-General for Education, Youth, Sport and Culture (2024).

future academic and professional choices (Hazari et al., 2010). This research project was an initial step in a pilot study to investigate a topic on which there appears to be no published literature in Portugal.

By focusing on early adolescence, this research addresses a gap in national studies and contributes to a more nuanced understanding of how gender stereotypes persist and evolve during this educational stage, which is particularly sensitive to identity construction and future academic trajectories.

3. Methodology

This exploratory study was conducted during the first week of the 2024/2025 school year in a lower secondary school, specifically in an 8th-grade class of the 3rd Cycle of Basic Education, located in the metropolitan area of Lisbon. The study involved 28 students, comprising 10 girls and 18 boys. The students were between 12 and 14 years old. Parents or legal guardians were requested to provide informed consent for the use of their children's materials. The sample was selected through convenience sampling, and no personal data were collected from the students other than their registered sex. As part of a presentation assignment in their Physics and Chemistry class, students were asked to depict how they imagine a scientist. Students were invited to use colored pencils, graphite pencils, or felt-tip pens, and each student was provided with a blank sheet of paper containing the instruction “Draw a scientist here”. The presentation form also contained other questions related to science learning in previous years, which will not be analysed in this study. The activity was completed within a 45-minute lesson.

This study adopts a quantitative research design, complemented by an interpretative qualitative analysis of students’ drawings. The quantitative analysis was based on a widely used checklist for drawing analysis in the context of the Draw-A-Scientist Test (DAST), known as DAST-C (Draw-A-Scientist Test Checklist). DAST was initially developed by Chambers (1983) with the primary purpose of asking children to draw a scientist and, through the analysis of these illustrations, to understand their perceptions of individuals working in science. The DAST, in its variants, has been applied to students of all ages, from primary to university education, to analyse their perceptions of scientists and to evaluate interventions aimed at changing those perceptions (Ferguson & Lezotte, 2020). Finson et al. (1995) expanded the original DAST by introducing nine additional indicators, resulting in the Draw-A-Scientist Test Checklist (DAST-C): male, Caucasian, indications of danger, presence of lamps, mythical stereotypes, indications of secrecy, working in closed environments, middle-aged or elderly, and other open comments.

To facilitate the analysis of students' responses, a list of items adapted from various authors' works was used in this investigation (Table 1).

Table 1
Indicators for representing a scientist.

Indicator DAST-C	Description	Examples/Search Symbols
1. Lab coat	Typical scientist's outfit.	White coat, uniform.
2. Glasses	Wearing glasses as a symbol of intelligence or a stereotype.	Round, large glasses.
3. Facial hair	Moustache or beard, usually associated with male scientists.	Long beard, thick moustache.
4. Research symbol	Scientific work tools.	Test tubes, glass flask, microscope, pipettes, and magnifying glass.

5. Knowledge symbol	Elements that indicate scientific reasoning or theory.	Formulas, equations, books, graphs.
6. Technology	Representations of technological tools.	Computers, robots, electronic equipment.

Note. DAST-C = Draw-A-Scientist Test Checklist (Finson et al., 1995).

Source: Authors' own elaboration.

Quantitative analysis was applied to the indicators listed in Table 1. In addition, an interpretative qualitative reading of selected drawings and open comments was conducted to support the contextual understanding of students' representations. To enhance analytical consistency, all drawings were independently examined by the researchers based on predefined indicators adapted from previous studies, with disagreements resolved through discussion.

The activity was conducted as part of regular classroom practice within a Physics and Chemistry lesson and did not involve any intervention beyond standard educational activities. No personal or identifying data were collected, and students' drawings were anonymised prior to analysis. Participants' confidentiality was ensured by anonymising all drawings prior to analysis and publication. Any identifying information (e.g., names or personal references) was removed or obscured, and each drawing was assigned to a numerical code. Only anonymised images are included in the article. The only variable recorded was the students' registered sex. Although sex and gender are not equivalent concepts, for methodological simplification, they were treated as overlapping in this study. It is important to note that students' gender was not asked; the classification was based solely on student information available to the teacher. The qualitative component does not aim at formal qualitative generalisation, but rather at enriching the interpretation of quantitative patterns identified in the data.

4. Results

The analysis reveals differences in output by students' gender (Table 2). While all female students identify scientists as wearing lab coats, only about 67% of male students do so. This trend is also evident in the representation of laboratory glasses, where only about 39% of boys represent them compared to 80% of girls, and in the "research" indicator (90% of girls marked this compared to only about 56% of boys). Regarding facial hair, the indicator for male scientists was observed in around 83% of boys and only 40% of girls. For the indicators "Knowledge" and "Danger", the percentages are of the same order of magnitude, with no significant differences between the two genders.

Table 2

Quantitative results of the indicators used to analyse the drawings.

Indicator	Frequency of female students	Percentage of female students	Frequency of male students	Percentage of male students	Total	Total percentage
Lab coat	10	100	12	67	22	79
Glasses	8	80	7	39	15	54
Facial hair	4	40	15	84	19	68
Research	9	90	10	56	19	68
Knowledge	1	10	2	11	3	11
Technology	1	10	4	22	5	18
Danger	2	20	5	28	7	25

Source: Authors' own elaboration.

In general, the indicator least associated with the figure of a scientist by the students is “Knowledge”, followed by “Technology”. This fact can be understood, according to Ferguson and Lezotte (2020), as students tend to view scientists more as individuals who use scientific instruments, such as test tubes, microscopes, and chemical reagents, rather than as those involved in the development of products like robots, machines, or vehicles. As for the indicator “Captions and labels”, only two students made any mention of it, as shown in Table 3.

One male student represented Einstein, considering various details, such as his high IQ, his brain being studied, his participation in the development of the nuclear bomb and the energy equation (Figure 1). A female student represented a NASA scientist. Several elements, including stars, rockets, and volcanoes, are featured in this representation (Figure 2).

Some students included captions and symbolic elements that allowed for a more detailed interpretation of their representations. These drawings often referred to well-known scientists or scientific institutions, revealing stereotypical associations between scientific knowledge, masculinity, and exceptional intellectual ability.

Figure 1

Representation of Einstein.



Source: Students' drawings collected by the authors.

Figure 2
Representation of a female NASA scientist.



Source: Students' drawings collected by the authors.

A third student, although not making any written references to the character's identity, depicted Isaac Newton sitting under the famous apple tree. Certain features, such as his long hair, the falling red apple, and a book in his hand, represent the image of this scientist often presented in school textbooks (Figure 3).

Figure 3
Representation of Isaac Newton.



Source: Students' drawings collected by the authors.

Table 3

Description of the “captions and labels” used by two students.

Captions and labels	Description	Student gender
Representation of Einstein	“RIP Einstein” next to a goblet containing a brain. “IQ”=180, referring to Einstein's IQ. “Boom” next to what represents a nuclear bomb explosion. “E=mc ² ” refers to Einstein's famous equation. The German flag is represented on the clothing.	Male
Representation of a female NASA scientist	Volcanoes, rockets and stars (sun and comet).	Female

Source: Authors’ own elaboration.

Female students produced four drawings depicting female scientists. This represents 14% of the total sample (4/28) and 40% of the girls participating in the study (4/10). Notably, no male students depicted female scientists in their drawings.

The selection of iconic figures such as Albert Einstein and Isaac Newton reveals the persistence of a canonical and personified understanding of scientific authority. These representations suggest that students associate scientific expertise with exceptional individuals whose legitimacy derives from historical recognition, genius, and symbolic visibility, rather than from everyday scientific practices. The reference to Einstein combines elements of intellectual brilliance, danger, and moral ambivalence, reflecting media narratives that portray scientists as both extraordinarily intelligent and potentially threatening.

Similarly, the representation of a NASA scientist indicates the influence of media-driven imaginaries that link science to spectacular, space-related contexts and prestigious institutions. Such choices point to a conception of science shaped by popular culture and school curricula, in which certain figures and organisations acquire celebrity status and symbolise scientific authority, overshadowing more ordinary, collaborative, and process-oriented forms of scientific work.

The low frequency of indicators related to “Knowledge” and “Technology” further reinforces this interpretation. The findings suggest that students tend to associate scientists primarily with external appearance and laboratory settings, rather than with intellectual work, theoretical reasoning, or technological innovation. This narrow conception of scientific activity reflects a visual and instrumental understanding of science, in which thinking, modelling, and problem-solving processes remain largely invisible.

From a pedagogical perspective, this has important implications. Science teaching may need to place greater emphasis on making the cognitive and creative dimensions of scientific work more explicit, highlighting how knowledge is constructed, debated, and applied in diverse contexts. Incorporating activities that foreground scientific reasoning, collaboration, and real-world problem-solving may help broaden students’ representations of what it means to do science and who can be a scientist.

Regarding representations of female scientists with clearly feminine features, these were created exclusively by 4 female students, accounting for 14% of the class. In addition to the common features described in Table 4, some feminine features are present in the drawings, associated with the students themselves. This is the case with well-groomed hair and prominent eyelashes (Figure 4), as well as a heart-shaped pendant necklace and trousers with finishing details (Figure 5). All the students were also Caucasian. The low number of technological elements can be explained by students' low technological literacy, according to Martins et al. (2023).

Figure 4
Representation of a female scientist.



Source: Students' drawings collected by the authors.

Figure 5
Representation of a female scientist.



Source: Students' drawings collected by the authors.

To further characterise the visual patterns associated with female scientists' representations, a set of common features identified across the drawings is summarised in Table 4. These elements provide additional insight into how gendered attributes are incorporated into students' depictions of scientific identity.

Table 4.

Common traits in representations of female scientists.

Common aspects of representations of women scientists
Caucasian origin (straight, long hair)
Glasses
Lab coat

5. Discussion

Given the small size and non-probabilistic nature of the sample, the results should be interpreted with caution, as they may not be representative of the broader population. However, the results of this study confirm the persistence of gender stereotypes in the representations of scientists by this sample of 3rd Cycle students, aligning with evidence from previous studies of younger age groups (Ferguson & Lezotte, 2020). In this regard, Bozzato et al. (2021) note that as students progress through their schooling, the stereotype of scientists' representation also becomes more pronounced. The predominance of masculine traits, such as facial hair and the absence of obvious feminine characteristics in the drawings, suggests that even among adolescents, the figure of the scientist is still conceived as masculine. When female scientists are represented, it is done by female students and features feminine traits, which may indicate an attempt to reconcile gender identity with the professional scientist.

In response to the first research question, only 14% of the students represented female scientists. Although all drawings depicting female scientists were produced by girls, fewer than half of the girls represented a female scientist (4/10). This result suggests that the traditional image of the scientist as male may still influence students' representations, including those of female students. These data are in line with the literature, specifically Miller (2018), which presents a systematic analysis of studies on DAST. Although the number of female scientists has been progressively increasing, the stereotype of the male scientist still prevails. Despite advances in gender equality and inclusion policies, gender scripts still dominate young people's imaginations, as seen in the difficulty in representing female scientists. The fact that only four female students represented female scientists, and that most male students drew figures with explicit signs of masculinity, shows how naturalised the symbolic division of professions is.

Regarding the second research question, the few representations of female scientists in the study - four in total, all drawn by female students - reveal relevant data on how girls perceive and relate to the figure of the scientist. Despite the underrepresentation of women in the drawings, these female representations feature visual elements strongly associated with the female universe, such as long, well-groomed hair, prominent eyelashes, heart-shaped necklaces, and clothing details. These traits suggest an attempt by the students to integrate characteristics of their personal identity into the image of the scientist. These female representations, although few, can be seen as attempts to appropriate the scientist's identity, adapting it to a gender logic that better aligns with students' experiences and expectations. On the other hand, the absence of boys representing female scientists confirms the idea that the figure of the scientist is still perceived as exceptional rather than as part of the norm.

Another aspect to highlight is the low representation of elements associated with "Knowledge" and "Technology" in the drawings. This absence may suggest that the image of the scientist remains strongly linked to visual cues (such as lab coats and glasses) and to scenarios of danger or laboratories, rather than to the theoretical and intellectual construction of science. This biased perception may influence how students perceive scientific knowledge and their sense of belonging in this field. Beyond the quantitative indicators, the qualitative examination of the

drawings provided important insights into how gendered meanings are attached to scientific identities. Visual details such as hairstyles, clothing accessories, facial expressions, and references to iconic scientific figures revealed symbolic dimensions that cannot be fully captured through frequency counts alone. These qualitative elements help illuminate how students negotiate gender identities in relation to science and reinforce the value of combining visual and interpretative approaches when studying gender stereotypes.

This study contributes to an area of research where a gap exists in the national literature, specifically the image of scientists among students in the 3rd cycle of basic education. The results confirm those obtained from students in the 1st and 2nd cycles: for most students, the image of a scientist is that of a man wearing glasses and a lab coat, associated with dangerous experiments. It was the female students who, albeit in small numbers, exclusively represented female scientists, often with feminine traits, thus holding a less stereotypical view than the boys.

The results suggest that gender stereotypes are not merely residual but actively reconstructed during early adolescence, reinforcing the need for targeted pedagogical interventions at this educational stage. At the same time, they must be interpreted in light of the study's contextual and methodological limitations. From a conceptual perspective, the results can also be understood through the lens of a gendered imaginary, as students' drawings reflect not only individual perceptions but also collectively shared symbolic constructions of what it means to be a scientist, shaped and normalised through cultural, educational, and media influences.

The limitations associated with the sample size and composition warrant further reflection. The study was conducted with a single class from an urban school in the Lisbon metropolitan area, which may differ from other Portuguese educational contexts, such as rural schools or regions with distinct socioeconomic profiles. Previous research suggests that exposure to diverse role models and educational resources may vary across contexts, potentially influencing students' representations of science and scientists. Therefore, caution is required when considering the transferability of these findings to other settings.

The gender distribution of the sample (10 girls and 18 boys) reflects the class's actual composition. While this imbalance limits the robustness of gender-based comparisons, the analyses were interpreted descriptively rather than inferentially.

6. Concluding remarks

As an exploratory and pilot study, these findings should be interpreted with caution. Nonetheless, they provide an important empirical baseline for future large-scale research on gendered representations of scientists in Portuguese lower secondary education.

From an educational standpoint, translating these findings into practice calls for more explicit pedagogical strategies. Science curricula could greatly benefit from the systematic inclusion of diverse examples of scientists, showcasing gender diversity, a range of scientific fields and career trajectories, and forms of scientific work beyond the traditional laboratory setting. Presenting scientists as collaborative, creative, and socially embedded professionals may help challenge narrow and stereotypical depictions.

Teacher education and professional development programmes play a pivotal role in this effort. Supporting teachers to recognise and critically reflect on their own implicit biases and to adopt inclusive pedagogical practices can help reshape how science is represented in classrooms. Furthermore, strengthening visual literacy education can empower students to critically analyse stereotypical images of scientists in textbooks, media, and popular culture, fostering more nuanced and inclusive understandings of science and those who practice it.

Several limitations must be acknowledged. As an exploratory study based on a small and non-probabilistic sample, the findings should not be interpreted as statistically representative of the broader student population. Nevertheless, the results may provide analytically relevant insights into patterns of gendered representations, consistent with findings reported in previous studies. They may therefore contribute to the understanding of similar educational contexts.

An additional limitation concerns the conceptual scope of gender stereotypes explored in this study. The DAST-C methodology primarily captures visual representations of scientists and therefore focuses on external characteristics, professional settings, and symbolic attributes. Broader dimensions of gender stereotypes in science, such as students' awareness of female scientists, perceptions of scientific achievement, or the historical invisibility of women in science, were not directly examined. Future studies could complement drawing-based methods with interviews or questionnaires to explore these dimensions in greater depth.

Future research should thus include more diverse and representative samples across regions, school types, and gender distributions, to assess the consistency of these patterns within the national education system. Extending this line of inquiry to other age groups, including upper secondary students and pre-service teachers, will be crucial for understanding how gendered representations evolve and how they shape scientific identities.

This study contributes to the literature in three main ways. First, it addresses a notable empirical gap by focusing on students in the 3rd cycle of basic education in the Portuguese context. This stage has received limited attention in prior research. Second, it extends existing DAST-based research by combining quantitative indicators with interpretative analysis, offering a more nuanced understanding of how gendered representations are constructed during early adolescence. Third, by mobilising the concept of a gendered imaginary, the study provides a conceptual lens that connects individual student representations with broader sociocultural and media influences, thereby enriching the theoretical interpretation of how gender stereotypes in science are internalised and reproduced.

Ultimately, this study highlights the need for continued research and educational action toward more equitable and inclusive representations of scientists, an essential step in making science education a space where all students can envision themselves as potential contributors to scientific knowledge.

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