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Who works in science communication? Identifying and characterising professional profiles in Spain

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Abstract. This research aimed at understanding the professional contexts of science communicators in Spain and at identifying which profiles emerged when exploring the group from a multidimensional perspective. We ran a survey with science communicators based in Spain (N = 242). A statistical cluster analysis was performed to classify survey responses into subgroups. This research has identified six professional profiles of science communication in Spain. They have been labelled as: 1) the emerging talented communicator; 2) the experienced institutional communicator; 3) the atypical communicator; 4) the AI-critical communicator; 5) the entrepreneurial communicator, and 6) the senior communicator. The article explores each of them in detail. Moreover, we have obtained data about the general characteristics of science communicators in the country, such as that they work mostly in the public sector (58.3%) and in "Institutional or corporate communication" (54.5%), "Social media and large digital platforms" (38%) and "Journalism and media" (31.8%); they primarily work in research centres (35.48%) and universities (10.89%) and, gender wise, they are mostly women (71.25%). Finally, barriers and opportunities of the profession, as well as the use of artificial intelligence, are also explored. This study identified, for the first time, the main professional profiles of science communication in Spain and the characteristics defining those dedicated to it. The findings have implications for the fostering of science communication professionalisation in the country.
Keywords. Science communication, science communicators, professional profiles, artificial intelligence.

ES ¿Quién se dedica a la comunicación científica? Identificación y caracterización de perfiles profesionales en España

Resumen. El objetivo de esta investigación es comprender los contextos profesionales de los comunicadores científicos en España e identificar qué perfiles emergen al explorar el grupo desde una perspectiva multidimensional. Se realizó una encuesta con comunicadores científicos en España (N = 242), y se implementó un análisis estadístico de clústeres para clasificar las respuestas en subgrupos. Se han identificado seis perfiles profesionales de la comunicación científica, etiquetados como: 1) talento emergente; 2) experto en comunicación; 3) comunicador atípico; 4) comunicador crítico con la IA; 5) comunicador emprendedor, y 6) comunicador sénior. Estos perfiles se exploran en detalle en el artículo. Además, se han obtenido datos sobre las características generales de los comunicadores científicos en el país, como que trabajan mayoritariamente en el sector público (58,3 %), en «Comunicación institucional o corporativa» (54,5 %), «Redes sociales y grandes plataformas digitales» (38 %) y «Periodismo y medios de comunicación» (31,8 %), que se encuentran principalmente en centros de investigación (35,48 %) y universidades (10,89 %) y, en cuanto a género, son mayoritariamente mujeres (71,25 %). Finalmente, se exploran las barreras y oportunidades de la profesión, así como el uso de la inteligencia artificial. Este estudio identifica, por primera vez, los principales perfiles profesionales de la comunicación científica en España y las características que definen a quienes se dedican a ella. Los resultados tienen implicaciones para el fomento de la profesionalización de la comunicación científica en el país.
Palabras clave. Comunicación científica, comunicadores científicos, perfiles profesionales, inteligencia artificial.

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1. Introduction

Throughout history, numerous examples have been documented of activities that have served as what we would now call public communication of science. However, it was in the 1980 when science communication became professionalised (Bucchi, 2013; Bultitude *et al.*, 2011). Nowadays, the professional practice of science communication is extremely varied and covers a multitude of roles and tasks (Hornig Priest, 2010; Metcalfe, 2022). In addition to the more traditional science communication activities —such as the media, magazines or museums—, a wide variety of formats and channels have emerged, ranging from popular books to citizen participation, social media campaigns, and science cafés (Davies *et al*., 2019). The literature provides with several analyses of these new formats: Riedlinger *et al*. (2019) analysed storytelling for science communication, Irani & Weitkamp (2023) studied the use of short science stories, Bultitude *et al.* (2011) explored science festivals, and Metcalfe (2019) studied citizen science activities. Moreover, it is interesting to consider that science communication practice is not governed by the same standards as other professions, in which it is a requirement to have a specific training in the field in order to be able to practice it professionally —such in, for example, law or medicine—; in science communication, however, practitioners come from a wide variety of educational backgrounds (Miller, 2008).

In the current era of "post-truth," good science communication is more necessary than ever and should not only promote understanding of science but especially a greater engagement in its process (Broks, 2017). Considering that the social conversation about science is a vital part of any modern culture (Bauer, 2013), and that science communication is crucial for the wellbeing of people, organisations and nations (Davies & Horst, 2016), the value of science communicators becomes clear. And with the current disregard for scientific evidence that permeates politics and even public health, the need for responsible science communicators who can critically reflect and consider their audience's needs and values is paramount (Jensen, 2022).

At a European level, four main trends have been identified that characterise science communication: 1) it is fragmented and diverse, with largely independent fields and activities with little interaction among them; 2) it finds itself at a moment of transition, so while its practice is growing, it is also changing; 3) it is highly context- and format-specific, both in its nature and impacts; and 4) it is oriented to dialogue and critical engagement, positively moving towards models of participation and multi-way communication (Davies *et al.,* 2021).

While it is timely to study the patterns that characterise a whole set of regions, it is also valuable to zoom in and investigate the reality of one country. In Spain, there is scarce literature examining the nature of science communication practice. There are two analyses about its historical evolution (Lopez & Olvera-Lobo, 2017; Revuelta *et al*., 2020), and two articles about its practice: Pont-Sorribes *et al.* (2013) studied how science journalists adopted new media, and Cassany *et al.* (2018) analysed the training of science journalists in the country. No further literature on the matter has been found.

Regardless, there are other indications —such as the success of professional science communication associations or the regular occurrence of science communication conferences— that point to the fact that science communication practice in Spain is professionalised. However, it is key to deeply understand the current situation of science communication practice in Spain, with its barriers and opportunities, to effectively promote its development and further its professionalisation for the benefit of society.

Finally, the context of the profession and the transformations impacting it also need to be considered. Specifically, the irruption and disruption caused by the current expansion of generative artificial intelligence (hereinafter, AI) in science communication. In an editorial from 2018, Tatalovic (2018) warned about AI-related risks for science communication, and urged science journalists to be more involved in decisions relating to AI uses so that it ended up helping —instead of hindering— an independent and critical practice (Tatalovic, 2018). In the same line, Schäfer (2023) made an argument in favour of making the most of AI's potential while trying to safeguard science communication's integrity and precision (Schäfer, 2023). A later study defended the need for developing guidelines for quality journalism in the age of AI, as they may contribute to a stronger profession in the longer term (Dijkstra *et al*., 2024). Similarly, Markowitz (2024) found that AI could potentially improve public understanding of science and social perceptions of scientists (Markowitz, 2024). Looking into the impact of AI on science communication matters because AI can revolutionise science communication (Alvarez *et al.,* 2024) and democratise it with easy-to-use tools for dissemination; however, caution needs to be exercised as these tools can also be used to spread mis- and disinformation (Biyela *et al.,* 2024). In this context, it is essential to assess the potential impact of AI on the profession and its profiles. Although some studies have been conducted on the use of AI in research or scholarly communication (González Morcillo, 2024; Lopezosa, 2023), research focused on the impact of AI on the practice of science communication in Spain is still missing.

2. Objectives

The main objective of this study is to identify and analyse the main professional profiles in science communication in Spain. The specific research questions are:

- RQ1. How can science communication professionals in Spain be characterised?
- RQ2. What are the opportunities and barriers for the profession?
- RQ3. How is generative artificial intelligence (AI) being used, and what are the perceived opportunities and risks associated with its use for science communication?

3. Methodology

Three methodologies were implemented: two qualitative —participant observation and semi-structured interviews—, and one quantitative —a survey. Moreover, the study had a scientific committee to assist with the phrasing of survey questions, the piloting of the survey and its dissemination. The scientific committee was integrated by 10 people —5 women and 5 men— in representation of various science communication roles in Spain.

3.1. Participant observation and semi-structured interviews

Participant observation is a relatively unstructured, interactive method for studying people in their daily routines and activities (Puri, 2010). For this study, the researcher observed eight science communication professionals throughout a workday. These observations were conducted between April and September of 2024. The average duration of the observations was 6:11 hours —range from 5:20 to 7:33 hours—. Field notes were taken by hand following an observation sheet.

To identify the people to be observed, the quadruple helix model was used (Carayannis & Campbell, 2009), by which industry, academia, administration and society are interconnected in a bi-directional, dynamic and multi-layered way (Schütz *et al*., 2019). For this study, we selected two people from each helix using an intentional sampling approach (Knott *et al.,* 2022).

Eight participant observations were complemented with semi-structured interviews, which lasted an average of 36:14 minutes —range from 23:35 to 52:13 minutes—. The interviews were recorded using a mobile phone. Both field notes and interview recording were anonymised.

Interviews were transcribed using the online automatic transcription program HappyScribe. The content was analysed using the qualitative analysis support programme ATLAS.ti (version 22). A thematic content analysis method was followed.

3.2. Survey

Considering participant observations' analysis, a survey was developed, directed at science communication professionals. The survey questions addressed the study's objectives but also the themes that had most prominently been raised during the observations. The survey was pilot-tested by the project's scientific committee. Open from 19/11/2024 to 5/12/2024, the survey was broadly distributed through channels to reach science communicators.

The survey received 314 responses; of those, 242 were considered valid. The 72 responses that were disregarded came from people who did not comply with the criteria to be professionals whose main source of income originated from science communication activities. To assess the robustness of this number of respondents, an approximation of the universe represented was estimated. To do so, we added up the number of people affiliated to professional science communication associations in Spain, together with the members of the two largest science communication WhatsApp groups. From the total figure (2192 people), we subtracted the percentage of possible duplicates —i.e., people who belong to more than one association and/or WhatsApp group—. A rough indicator of the percentage of duplicates was provided by the survey responses (see 4. Results), as 32.5% of respondents mentioned they belonged to more than one association. The adjusted number indicated that the universe of science communication professionals in Spain was approximately 1 500 people. This number is, obviously, an estimation, as there is no other way to accurately determine the universe studied. Notwithstanding the rough calculation, the 242 responses achieved a statistical robustness of 90% with a margin of error of 4.9%.

The raw data were cleaned in Excel. For statistical analysis, all survey data were imported into R software. For the clustering analysis, we first converted the variables into three types: categorical, ordinal and binary encoded. Then, we used a selection of the variables in the survey based on their importance and complexity. To conduct the clustering analysis of mixed data types, we used the Gower's distance, which applies different measures of similarity for each data type. Next, we used the distance metric to conduct a hierarchical clustering with the "ward. D2" method. Finally, based on the distribution of the dendrogram and the visualisation of the variables, six clusters were identified. Clustering is a statistical machine learning technique that involves grouping data points based on their similarities (Gao *et al.*, 2023), seeking to identify a finite set of groups to describe the overall data (Fonseca, 2012), classifying multivariate information into subgroups to help reveal any structure or patterns present (Everitt, 1980).

4. Results

Six major professional profiles were identified for science communication practice in Spain. A detailed description of each of them follows.

1. "The emerging talented communicator"

This profile is characterised by people who work in the public sector (86.36%), mostly on institutional communication (84.09%). They are highly trained in science communication —75% with master's degrees— and have embraced the use of AI at work (77.27%). They have the shortest professional trajectories —59.09% between 0-5 years—, which could be because they are also the youngest cluster, with people being mostly between 18-40 years old (81.82%) and with the highest ratio of 18-30-year-olds (31.82%). They are the profile with the least people under their charge —only 13.64% do so—. They are also the ones that get paid the least, with the highest ratio of 18.000-35.000 euros annually (75%). Even though their contracts are mostly integrated into the formal structure of their organisations (67.44%), this is one of the profiles with higher ratios of not formally integrated contracts (32.56%), indicating a level of instability. Their most common team size is 2-5 people (47.73%). Despite their short career, a majority is affiliated to a professional association (65.09%). Their educational background is mostly in Biology (52.27%). They are the profile that considers themselves the least up-to-date with advances in science communication research —75% vote 1 or 2 in a scale of 1-5—.

2. "The experienced institutional communicator"

This profile is similar to the previous one in the sense that people work in the public sector (70%) mostly on institutional communication (80%). They are also highly trained in science communication —54%

have master's or postgraduate degrees— and have embraced the use of AI at work (86%). However, their professional trajectories are wide-ranging, with a relatively homogeneous representation of careers spanning 6-10 years (30%), 11-20 years (32%) and, to a lesser extent, more than 20 years (26%). With regards to age, people in this cluster are evenly distributed between 41-50 years old (34%) and 51-61 years old (34%). Most of them have people under their charge (54%). They get paid the most, with 42.86% receiving between 36.000-45.000 euros annually, and registering the highest percentage of people earning more than 46.000 euros per year (18.37%). Their contracts are mostly integrated into the formal structure of their organisations (65.31%) but with a notable amount not formally incorporated (30.61%). They usually work in teams of about 2-5 people (58%), and are the profile with the highest ratio of people affiliated to a professional association (70%). Their most common educational background is in Journalism (54%). They consider themselves to be relatively up to date with advances in science communication research —38% vote 3 in a scale of 1-5, and 34% vote 4 or 5—.

3. "The atypical communicator"

This profile represents those in the public sector (88%) that are characterised by working in science outreach in other formats (56%). This means, they don't frequently identify with common work typologies —such as institutional communication, social media or journalism and media—, but rather, classify themselves as working in science outreach in alternative formats such as books or theatre. The next most common work typology for this profile is research and training in science communication (28%), being the group that registers the highest percentage of this type of work. Although they do not have as many master's or postgraduate degrees in science communication, they have attended shorter training on the topic —64% courses or workshops—. They have embraced the use of AI at work (80%). Their professional trajectories are found in the extremes: they are either 0-5 years (32%) or more than 20 years (28%). Age-wise, the most common group of this cluster is 41-50-year-olds (44%). They are the profile with the most people under their charge (64%). Their annual salaries are evenly distributed between 18.000-35.000 euros (37.5%) and 36.000-45.000 euros (37.5%). Their contracts are integrated into the formal structure of their organisations (88%), and they work in teams of 2-5 people (36%) or 6-10 people (36%). They are generally affiliated to a professional association (68%). Their educational background is also atypical, as they mostly classify themselves in "Others" (56%), including Physics, Audiovisual communication or Biochemistry. They consider themselves up to date with advances in science communication research —on a scale of 1-5, 45.83% vote 4 or 5, while 20.83% vote 1 or 2, and the remaining 33.33% vote 3—.

4. "The AI-critical communicator"

This profile characterises those who work in the public sector (83.33%) mostly on institutional communication (77.78%) and journalism and media (58.33%) —the percentages add up to more than 100% because this was a multiple-choice question—. Although they do not have as many master's or postgraduate degrees in science communication, they have attended shorter training on the topic —69.44% courses or workshops—. This profile is specially defined by the fact that the majority of them have not embraced the use of AI at work —66.67% do not use AI—. Their professional trajectories are relatively short —63.89% 0-10 years—. In spite of their brief careers, their age is evenly distributed —50% between 18-40 years old, and 50% between 41-60 years old—. They do not have people under their charge —only 27.78% do— and their annual salaries are between 18.000-35.000 euros (72.22%), the lowest after the cluster "The emerging talented communicator". Their contracts are formally integrated into the structure of their organisations (80.56%) and they tend to work in teams of about 2-5 people (52.78%). This is the cluster with the lowest ratio of affiliation to a professional association (30.56%). They have studied mostly Journalism (50%). Regarding how updated they consider themselves about the advances in science communication research, this cluster is very evenly distributed —36.11% vote 4 or 5 in a scale of 1-5, 36.11% vote 3, and 27.78%% vote 1 or 2—.

5. "The entrepreneurial communicator"

This profile represents those who work in the private sector (56.60%) both as freelancers (39.62%) or employees (37.73%), registering the highest percentage of company owners (13.21%). They work primarily in social media and digital platforms (50.94%). The majority has received specialised training in science communication —54.72% with master's or postgraduate degrees—. They have absolutely embraced the use of AI at work (98.11%). Their professional trajectories run for up to 10 years (50.94%). Age-wise, they are evenly distributed among 31-40 years old (26.42%), 41-50 years old (24.53%) and 51 to 60 years old (22.64%). They generally do not have people under their charge —only 22.64% do—, and their annual salaries tend to be between 18.000-35.000 euros (52.83%). Their contracts are homogeneously distributed between those whose contracts are integrated in the formal structure of their organisations (46.15%) and those who work as freelancers (46.15%). People in this profile generally work alone, without a team (33.21%) or in small groups of 2-5 people (30.19%). They are affiliated to professional associations (66.04%). Regarding their educational background, they have most commonly studied Biology (33.96%) and other varied degrees (30.19%). They do not consider themselves to be up to date regarding the advances in science communication research —47.06% vote 1 or 2 in a scale of 1-5, while 27.45% vote 4 or 5—.

6. "The senior communicator"

This profile is characterised by those who work in the private sector (38.23%) or in both public and private (29.41%), either as employees (47.06%) or freelancers (41.18%). They are in the fields of journalism and media (44.12%), science outreach in other formats (44.12%) and museography and informal education

(41.18%). Regarding these professional typologies, it is interesting to note that this profile registers the highest ratio of people from museography and informal education, and the second highest from journalism and media. Half of them have received specialised training in science communication, although limited to courses or workshops (52.94%), and they are also the group with the highest percentage of people without any kind of training (38.24%). They have not integrated the use of AI at work —82.35% do not use AI—. This profile has the longest careers, with most having worked over 20 years (58.82%). Not surprisingly, this is also the profile that registers the highest percentage of people between 51-70 years old (64.71%). They don't tend to have people under their charge —only 35.29% do—. Their yearly salaries are quite evenly distributed between 18.000-35.000 euros (32.35%) and 36.000-45.000 euros (35.29%); however, it is worth noting that this is the cluster with the highest ratio of people earning less than 18.000 euros per year (17.65%). With regards to their contracts, they are either integrated into the formal structure of their organisations (50%) or they work as freelancers (40.63%). Their teams are generally of about 2-5 people (44.12%). The majority is affiliated to a professional association (67.65%). They have studied a variety of degrees, such as Physics, Audiovisual communication or Biochemistry ("Others", 32.35%). They consider themselves to be the most up to date regarding the advances in science communication research —52.94% vote 4 or 5 in a scale of 1-5—.

4.1. How can science communication professionals in Spain be characterised? (RQ1)

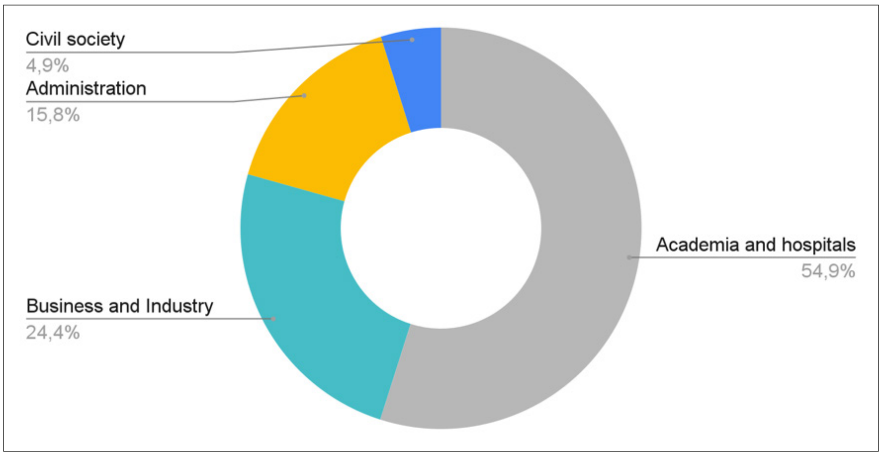
4.1.1. Area or sector

The majority of science communicators work for the public sector (N = 141, 58.3%), particularly in Academia and hospitals (N = 146, 61.1%) (Figure 1).

Science communicators primarily work in research centres (N = 88, 35.48%), universities (N = 27, 10.89%) and science museums (N = 21, 8.47%) (Figure 2).

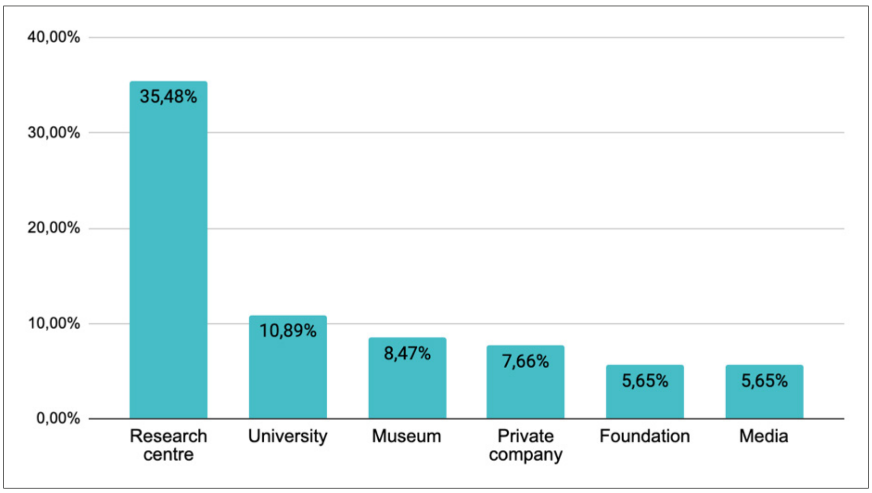
The most common professional typology is "Institutional/corporate communication" (N = 132, 54.55%), followed by "Social media and large digital platforms" (N = 92, 38.02%) and "Journalism and media" (N = 77, 31.82%) (Figure 3).

Figure 1. Distribution of the helices to which respondents belong.



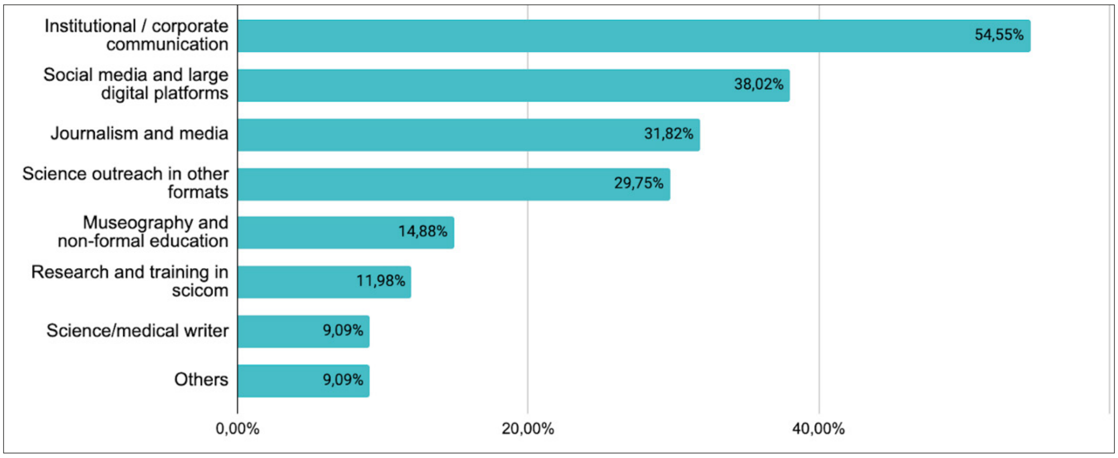
Source: Own production.

Figure 2. Distribution of the type of organisations of respondents. Only included here options with 14 or more votes, representing 74% of responses.



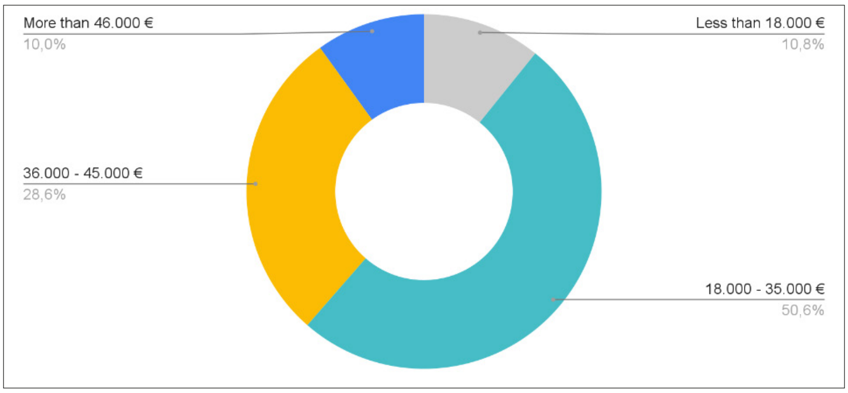
Source: Own production.

Figure 3. Distribution of the professional typology of respondents.



Source: Own production.

Figure 4. Distribution of annual gross income of respondents.



Source: Own production.

4.1.2. Professional context

Most science communicators are employees, that is, work for someone else (N = 176, 73.33%), and their contracts are integrated into the formal structure of their organisation (N = 152, 62.81%). Almost a fifth indicate their contract is not part of the organisation's formal structure (N = 46, 19.01%), meaning, it's either project-dependant or subcontracted. Almost half of respondents work in small teams, of between 2-5 people (N = 109, 45.04%), followed by in teams of 6-10 people (N = 50, 20.66%).

Most people have others under their charge (N = 159, 65.70%), have worked in science communication for more than 11 years (N = 112, 46.28%), and have an annual gross income of between 18.000-35.000 euros (N = 122, 50.62%) (Figure 4).

When the variable of annual gross income is crossed with their work typology, we observe statistically significant differences only in the fact that people working in Administration are more present in the highest salary range, "more than 46.000€" —Fisher's Exact test, P-value < 0.05—. Most science communicators are affiliated with a professional association (N = 151, 62.92%).

4.1.3. Tasks

The most common tasks among science communicators relate to communication actions such as content writing, press releases, video or podcast, among others (N = 175, 72.31%), followed by event organisation (N = 113, 46.69%) and social media management (N = 98, 40.50%). To do their jobs, science communicators consider the most important competencies to be "journalistic and audiovisual skills" (N = 125, 51.65%), "team work" (N = 96, 39.67%) and "adaptation to change" (N = 95, 39.26%).

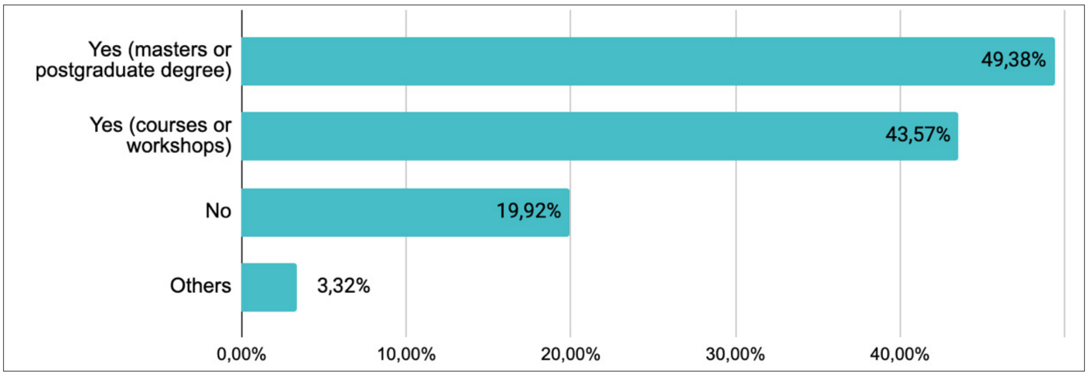
Half of respondents have studied a master or postgraduate degree in science communication (N = 119, 49.38%), while almost a fifth have not undertaken any science communication training (N = 48, 19.92%) (Figure 5). There are no statistically significant differences between training level and annual gross income.

It is widely agreed that science communication training is useful or very useful to practice the job (N = 186, 77.18%). Statistically significant differences show that those who have studied a master's or a postgraduate degree in science communication indicate higher values of the usefulness of the programmes —Fisher's Exact test, P-value < 0.0005—.

With regards to their connection with research, when given a scale (1-5) to determine how up to date they are regarding the advancements in science communication research, only 32.77% (N = 78) vote with scores of 4 or 5. The most voted option is the intermediate position of "3" (N = 67, 28.15%) (Figure 6).

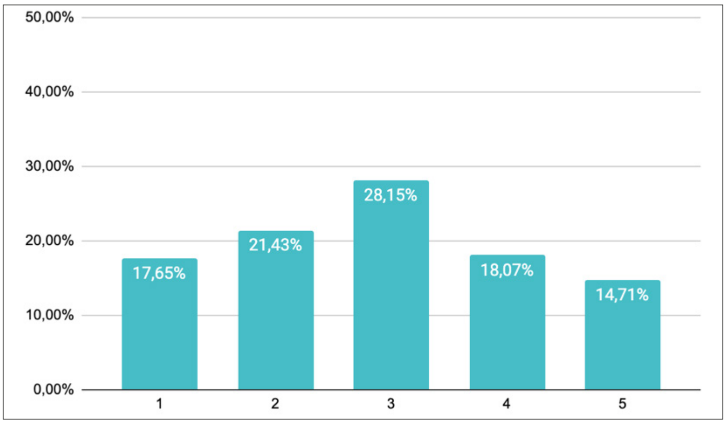
Almost a third of science communicators impart seminars or workshops on science communication for scientists (N = 71, 29.71%). To a lesser extent, they supervise undergraduate, postgraduate or graduate

Figure 5. Distribution of specialised training in science communication of respondents.



Source: Own production.

Figure 6. Distribution of votes for the question "Are you up to date with advancements in science communication research, and do you try to integrate its results in your professional practice?".



Source: Own production.

students (N = 37, 15.48%), or impart seminars or workshops for communicators (N = 32, 13.39%). A larger portion, however, indicates they have no connection with science communication training (N = 104, 43.51%).

4.1.4. Demographic characteristics

Survey findings show that science communicators in Spain are mostly women (N = 171, 71.25%), and quite homogeneously distributed among three age groups: 31-40-year-olds (N = 69, 28.5%), 41-50-year-olds (N = 62, 25.6%), and 51-60-year-olds (N = 58, 24%). Science communicators live throughout the 17 autonomous communities of Spain, the most represented being Catalonia (N = 116, 48.54%), Madrid (N = 46, 19.25%) and Valencia (N = 19, 7.95%). Half of the sample lives in cities with more than 500.000 inhabitants (N = 122, 51.7%). In terms of their highest level of education achieved, it is most common to have obtained a master's degree (N = 135, 56.02%), followed by a doctorate (N = 51, 21.2%). The most common type of studies among science communicators are Biology (N = 59, 26.11%) and Journalism (N = 49, 21.68%).

4.2. What are the opportunities and barriers for the profession? (RQ2)

The main opportunities for science communication are considered to be the advances in science communication research, which can help the profession progress (930 votes), followed by the profession's ability to raise awareness about diverse role models (929 votes) and that the profession is experiencing a period of growth and consolidation (893 votes).

In contrast, the main barriers to science communication practice are insufficient economic resources (824 votes), the fact that potential employers and decision-makers are not aware of the existence of such a role (816 votes) and the insufficient scope of science communication activities, which always seem to reach the same audiences (802 votes).

4.3. How is AI being used, and what are the perceived opportunities and risks associated with its use for science communication? (RQ3)

Almost 70% of science communicators use AI at work (N = 167, 69.01%). There are no statistically significant differences between genders, age groups or annual gross income level.

The main benefits associated with the use of AI are that it helps save time and makes work more efficient (N = 153, 87.43%), together with allowing practitioners to dedicate more time to tasks with added value (N = 110, 62.86%) and followed by increased creativity (N = 85, 48.57%). In contrast, the main perceived risk linked to the use of AI is the disinformation it may cause (N = 160, 69.26%), followed by the biases it can perpetuate (N = 110, 47.62%) and that it may negatively impact content quality (N = 104, 45.02%).

5. Discussion and conclusions

This study has identified and analysed for the first time the main professional profiles of science communication in Spain. Findings indicate that there are six prominent profiles in the practice of the public communication of science. Based on their defining traits, they have been labelled as: 1) The emerging talented communicator; 2) The experienced institutional communicator; 3) The atypical communicator; 4) The AI-critical communicator; 5) The entrepreneurial communicator; and 6) The senior communicator.

Profiles 1-4 work for the public sector, whereas profiles 5-6 work for the private sector. In either group, only one of the profiles does not use AI (4 and 6), which could be attributed, in both cases, to their age. Among profiles in the public sector (1-4), a wide variety of professional typologies, careers and salaries are represented; however, among profiles in the private sector (5-6), this variety is not as broad. The identified profiles represent the current state of science communication in Spain and indicate that it is a consolidated profession in the country.

In answer to the first research question, "How can science communication professionals in Spain be characterised?", they can be defined by several aspects. Regarding their area or sector, most work in the public sector and in academia, primarily in research centres, universities and science museums, and in "Institutional/corporate communication", "Social media and large digital platforms" and "Journalism and media". It is interesting to notice the discrepancy between the amount of people who identify as working in "Journalism and media" (31.81%) (Figure 3) and those who mark "Media" as their organisation type (5.65%) (Figure 2). This inconsistency could reflect a well-known phenomenon: driven by economic imperatives and technological changes, science journalists leave the media to undertake a wider plurality of roles (Fahy & Nisbet, 2011), which can include shifting from science journalism to public relations (Franks *et al.,* 2022; Murcott & Williams, 2013).

Most science communicators are affiliated to a professional association, have more than 11 years of experience, work in small teams, and have people under their charge. This last point, by which 65.70% of respondents have others under their charge, indicates that science communicators work in middle to high hierarchical positions. Regarding their annual gross income, most professionals earn between 18.000-35.000 euros annually. The fact that statistically significant differences were observed for those working in the Administration —where the highest ratio of people earning more than 46.000 euros per year was found— means that the best paid positions, and probably the ones with most responsibility, are found in the Administration. The fact that 62.81% of contracts are integrated into the formal structure of their organisation demonstrates the consolidation of science communication as a profession. However, it must be noted that almost a fifth, 19.01%, work with a contract that is not part of the organisation's formal structure, which illustrates a certain level of job insecurity or uncertainty.

Science communicators consider the most important competencies to be "journalistic and audiovisual skills", "team work" and "adaptation to change". These findings resonate with a previous study analysing, among others, the competencies considered most relevant to find and practice a job by the alumni of science communication training in Spain (Saladié *et al.*, 2023); in that analysis, alumni indicated the most relevant competencies were self-learning, adaptation to change and innovation.

Science communicators are not particularly aware of the advancements in science communication research. This coincides with previous research reporting a disconnect between science communication practice and research (Davies *et al.*, 2021; Han & Stenhouse, 2015; Miller, 2008). Some authors have observed that the impact of academic research on practice is limited (Anjos *et al.,* 2021), that most scientific publications remain inaccessible to most practitioners as they are behind paywalls (Gerber *et al.*, 2020), or that hardly any practitioners read scholarly journals (Miller, 2008). Practitioners are, however, connected to science communication training, specially by imparting seminars or workshops to scientists, and half of them have studied a master or postgraduate degree in the field. They generally agree that science communication training is useful or very useful to practice the job, which aligns with previous research indicating that alumni from science communication master's and postgraduate degrees considered their studies to be useful to find and practice a job (Saladié *et al.,* 2023).

With regards to their demographic characteristics, science communicators are primarily women, coinciding with previous literature (Miller, 2008; Schäfer *et al.*, 2020). Age-wise, the profession is quite homogeneously distributed among three age groups: 31-40, 41-50 and 51-60-year-olds. Not much literature on this matter can be found, save for two studies: while one indicates that science journalists are older than other types of journalists (Schäfer *et al.,* 2020), the other suggests it is a relatively young community (Miller, 2008). Their most common backgrounds are in Biology or Journalism, which partially matches previous literature indicating that the most common backgrounds of science journalists were the undergraduate degrees of journalism or communication (Cassany *et al.,* 2018).

In response to the second research question, "What are the opportunities and barriers for the profession?", the main opportunities are the advances in science communication research, which can help the profession progress. This coincides with previous literature suggesting that research and practice would benefit from integrating into one another (Fischer *et al.,* 2024; Gerber *et al.,* 2020; Pitrelli, 2009; Scheufele, 2022). However, survey responses also indicate that the current connection of science communicators with research is not particularly strong. Another opportunity for science communication appears to be the profession's ability to raise awareness about diverse role models. This opportunity aligns with the trend observed in recent years paying special attention to diversity and inclusion in science communication (Lewenstein, 2024), highlighting the need for science communication to become a field that supports pluralistic societies (Canfield *et al.*, 2020).

Regarding the barriers faced by the profession, science communicators consider the main one to be the insufficient economic resources. This coincides with previous literature, which calls for more funding for long-term science communication endeavours and more supportive environments (Prokop & Illingworth, 2016; Rose *et al.,* 2020). Another barrier highlighted by practitioners is the insufficient scope of science communication activities, meaning, they always end up reaching —or neglecting— the same audiences. This barrier has also been identified in the literature (Jensen *et al.,* 2015; Ocobock & Hawley, 2020; Rader & Gibbs, 2024), highlighting that science communication should reach "publics whose demographic, socio-structural, or value-based characteristics position them squarely outside of the proverbial choir that science communication is often preaching to" (Scheufele, 2018).

The last of the research questions was "How is AI being used, and what are the perceived opportunities and risks associated with its use for science communication?". This study indicates that 69% of science communicators use AI at work. The main benefits associated with its use are that it helps save time and makes work more efficient, it allows practitioners to dedicate more time to tasks with added value, and that it helps increase creativity. These benefits coincide with previous literature highlighting AI's potentialities, including its capacity to help in tasks such as translations, summaries, or social media posts (Metag, 2024), or assisting with news articles, slogans or headlines, among others (Schäfer, 2023). In contrast, the perceived risks associated with the use of AI have to do with the disinformation it may cause, the biases it can perpetuate or the fact that it may negatively impact content quality. These findings also resonate with other literature pointing at the potential malicious uses of AI to spread mis- or disinformation (Biyela *et al.,* 2024), or highlighting the need to safeguard science communication's integrity and precision (Schäfer, 2023).

6. Limitations

The findings of this study have to be seen in light of two limitations, which could be addressed in future research. First, the sample of the qualitative phase of this study –8 people—only includes one man. Although the findings of the study show that 70% of science communication professionals are women, and therefore it is apparent that the profession is feminised, still it would have been preferable to have a more gender-balanced sample. And second, the geographical representation of the sample could be biased, since one autonomous community accounts for 50% of responses. This could be an overrepresentation caused by the fact that the authors are based in that same region, or due to the high number of subscribers of the professional association's mailing list of that autonomous community –at the time, 778 people–.

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8. Authors' contribution

Conceptualization	Ideas; formulation or evolution of overarching research goals and aims.	Authors1, 2 and 3
Data curation	Management activities to annotate (produce metadata), scrub data and maintain research data (including software code, where it is necessary for interpreting the data itself) for initial use and later re-use.	Author 1
Formal analysis	Application of statistical, mathematical, computational, or other formal techniques to analyse or synthesize study data.	Author 1
Funding acquisition	Acquisition of the financial support for the project leading to this publication.	Authors 2 and 3
Investigation	Conducting a research and investigation process, specifically performing the experiments, or data/evidence collection.	Authors 1, 2, 3
Methodology	Development or design of methodology; creation of models.	Authors 2 and 3
Project administration	Management and coordination responsibility for the research activity planning and execution.	Author 2
Resources	Provision of study materials, reagents, materials, patients, laboratory samples, animals, instrumentation, computing resources, or other analysis tools.	Author 3
Software	Programming, software development; designing computer programs; implementation of the computer code and supporting algorithms; testing of existing code components.	Authors 1, 2 and 3
Supervision	Oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.	Author 3
Validation	Verification, whether as a part of the activity or separate, of the overall replication/reproducibility of results/experiments and other research outputs.	Author 3
Visualization	Preparation, creation and/or presentation of the published work, specifically visualization/data presentation.	Authors 1 and 3
Writing / original draft	Preparation, creation and/or presentation of the published work, specifically writing the initial draft (including substantive translation).	Author 1
Writing / review & editing	Preparation, creation and/or presentation of the published work by those from the original research group, specifically critical review, commentary or revision –including pre- or post-publication stages.	Authors 1, 2 and 3

9. Statement on the use of artificial intelligence

No artificial intelligence tools were used in this article.

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