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ARTICLE / ARTÍCULO

Implications, contradictions and possibilities of open science in Spain: The REUNI+D case

Implicaciones, contradicciones y posibilidades de la ciencia abierta en España: El caso REUNI+D

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Abstract: This article reviews the status of open science as a paradigm of scientific practice that is currently being implemented. It addresses the policies developed by the European Union and their specific implementation in Spain, as well as the discrepancies and barriers that their implementation is encountering in the Spanish university system. It then examines the REUNI+D network in more detail, describing the activities and proposals carried out by its 14 educational research groups from 13 Spanish universities between 2019 and the present day. A mixed research methodology is employed, incorporating a questionnaire as a tool to identify the knowledge and perceptions of network members on science and open education, as well as the obstacles encountered. The findings indicate that members possess precise understanding of the concept of open science and its potential to foster collaboration, accessibility, and comprehension of the entire research life cycle. This underscores the necessity for training processes to be developed within the new framework. The final discussion highlights the difficulty for each higher education institution to generate different policies and regulations in this regard, leading to contradictions in evaluation and the need for the three Cs (Coherence, Collaboration and Coordination) for the development of open science.

Keywords: Open Science, Research Networks, Universities, Institutional Cooperation.

Resumen: En este artículo se repasa la situación de la ciencia abierta como paradigma de la práctica científica que se encuentra en pleno proceso de implantación, abordando las políticas desarrolladas por la Unión Europea y su desarrollo concreto en España, así como las discrepancias y barreras que está suponiendo su implantación en el sistema universitario español. A partir de aquí se estudia el caso concreto de la Red REUNI+D, que abarca 14 grupos de investigación educativa de 13 universidades españolas desde el año 2019 hasta la actualidad donde se describen las actividades y propuestas realizadas en su marco. Se utiliza una metodología de investigación mixta con el uso de un cuestionario como instrumento para identificar el conocimiento y las percepciones de los miembros de la red sobre ciencia y la educación abierta, así como los obstáculos. En los resultados se constata que los miembros tienen un conocimiento certero sobre qué es la ciencia abierta y las posibilidades que abre a la colaboración, la accesibilidad y a conocer todo el ciclo de vida de las investigaciones, resaltando la necesidad de procesos formativos sobre el nuevo marco generado. En la discusión final se pone de relieve la dificultad de que cada institución de educación superior genere una política y normativas diferentes al respecto, generando contradicciones en la evaluación y la necesidad del trabajo de las tres C (Coherencia, Colaboración y Coordinación) para el desarrollo de la ciencia abierta.

Palabras clave: Ciencia Abierta, Redes de investigación, Universidades, Cooperación institucional.

1. Introduction

Open Science is defined as

«an inclusive construct that combines various movements and practices aiming to make multilingual scientific knowledge openly available, accessible and reusable for everyone, to increase scientific collaborations and sharing of information for the benefits of science and society, and to open the processes of scientific knowledge creation, evaluation and communication to societal actors beyond the traditional scientific community» (da Silveira et al., 2023, p.3).

It is implied that advances are available to all, especially when they have been developed with public funding from states, and that publications, data, practices, methodologies and processes derived from research are accessible to the scientific community and the public. Furthermore, it places emphasis on the involvement of citizens, emphasising the commitment to fostering socially responsible research environments and initiatives. The objective is to disseminate the processes and outcomes of research to both the scientific community and the society that funds it. This approach is instrumental in facilitating the replication of research findings and promoting the dissemination of their social value.

1.1. Open science in Europe and Spain

At least ten of the seventeen Sustainable Development Goals (SDGs) that make up the 2030 Agenda for Sustainable Development require ongoing scientific input. Given that these goals must be achieved globally, it is absolutely necessary to remove restrictions on the dissemination of research results to the intended stakeholders, regardless of their geographical location and the financial situation of the institutions and individuals seeking information (UNESCO, 2014). On 27 May 2016, all Member States of the European Union committed to making publicly funded scientific results available online, at no additional cost to other researchers in the research community, as well as to policy-makers, businesses and the general public. However, as reported by the EU Commissioner for Research, Science and Innovation in September 2018, 'despite this commitment, a large number of scientific articles continue to be published in journals that are only accessible to those who can and are willing to pay subscription fees'. Several obstacles still need to be addressed.

UNESCO (2021) argues that scientific knowledge is a common good and should be shared. This principle has been adopted by the European Union, which has been developing an open access strategy since 2018, requiring that the results of the research it funds be published in universally accessible and free journals and platforms. In line with other institutions (UNESCO, UN, etc.), it aims to address the challenges of an increasingly digitalised society from the perspective of promoting sustainability and building a global, open, stable and secure cyberspace. In its declaration on Open Educational Resources (OER), UNESCO (2024) affirms the transformative potential of Open Education (OE) and Open Science (OS) as a cornerstone for equitable and inclusive access to knowledge in the digital age.

Since 2020, scientists and researchers who receive research funding from EU state agencies and institutions have been required to publish their work in open

repositories or in accessible journals (see the 7th Framework Programme (FP7), Horizon 2020 and Horizon Europe).

That said, we can conclude that the incorporation of OS in different EU countries has progressed, but there are still challenges that have yet to be addressed and tasks that remain to be accomplished in order to put theory into practice. It is essential to develop a regional regulatory framework that enables collaborative work and growth among institutions in the same geographical region. Specifically, teaching and research staff must be trained; policies recognising open science activities must be adopted; university governing bodies with competences in this area must be involved; and practices for disseminating institutional strategies must be developed. Addressing these issues is fundamental to consolidating Open Science and achieving significant cultural change within institutions.

Spain is committed to open science through the Science, Technology and Innovation Act and the Organic Law on the University System (LOSU). Within this framework, it is mandatory to deposit a copy in this type of digital repository, without prejudice to its availability elsewhere. Progress has already been made in evaluating researchers' scientific output over six-year periods and in the rules imposed by the Spanish Research Agency on the financing of research projects. To implement these initiatives, repositories have been created in universities and research centres. Nevertheless, research results continue to be evaluated based on publication in top-ranked international journals, which are generally owned by private corporations that charge high fees for open access.

Efforts have been made in this regard in Spain. In 2007, RECOLECTA, the national aggregator of open access repositories, was launched. This platform brings together all Spanish digital infrastructures where research results are published and/or deposited in open access. In 2009, OpenAIRE¹ was created, funded by the Seventh Framework Programme. It is a service platform to support, accelerate and measure the proper implementation of European open access policies for scientific publications and research data. OpenAIRE has a large network of agents who act as national reference points to disseminate and promote the European Commission's open access policies among institutions and researchers, as well as to facilitate the coordination of national policies with European ones. In June 2018, FECYT launched the pilot project 'Infrastructures and Standards for Open Science' (INEOS)² in collaboration with three public research bodies: the Spanish National Research Council (CSIC)³, the Carlos III Health Institute (ISCIII)⁴ and the National Institute for Agricultural and Food Research and Technology (INIA)⁵. The objective was to link the results of publicly funded research with the data used in the research, with the aim of improving the quality of data in repositories and increasing researchers' visibility by creating public CV profiles in various institutional spaces.

On 19 February 2019, the General Assembly of the CRUE approved the «Commitments of Universities to Open Science» document⁶. In line with this, Spanish

¹ <https://www.openaire.eu>

² <https://bit.ly/ineosfecyt>

³ <https://www.csic.es/es/el-csic>

⁴ <https://www.isciii.es/inicio>

⁵ <https://www.inia.es/>

⁶ <https://bit.ly/cruccienciaabierta>

universities have clearly committed to the so-called 'green route' over the last decade by developing institutional repositories and approving policies that require, encourage or recommend the self-archiving of publications. Consequently, 105 repositories have been established in research centres and universities based on these institutional policies. Additionally, in line with the European Union's approach, Article 37 of the Science, Technology and Innovation Act stipulates that any publication resulting from a project financed mainly from the Spanish state budget must be deposited in an open access repository. However, the percentage of content hosted in open repositories does not yet reach the desired level for 2020, with some exceptions. Measurement of Open Access in Spanish universities and the CSIC for the period 2019–2023 (CRUE, 2025) shows a significant increase in the percentage of open-access articles: from 75.6% (77,731 publications) in 2022 to 80% (82,413 publications) in 2023. These figures vary depending on the centre. Despite all these efforts, Europe and Latin America have not yet been able to adopt Open Science initiatives on a widespread basis.

1.2. Open Science, universities and platform capitalism

The paradigm shift initiated by open science and education must be accompanied by a comprehensive review of university policies, encompassing essential modifications to incentive policies and project evaluation, as well as the working culture of the various stakeholders within R&D systems. Consequently, universities are confronted with considerable challenges and are compelled to address the contradictions that may emerge.

Research in this area has highlighted discrepancies between the concept of open science and academic reality, identifying two main barriers: individual and systemic (Scheliga & Friesike, 2014). In essence, a number of authors have arrived at the conclusion that, upon rigorous examination of the deficiencies inherent in contemporary science that the open science movement is designed to address, the prospects for enhancement appear to be negligible (Mirowski 2018). In this context, collaborative practices and research networks are considered essential elements for innovation and open science (Ramírez-Montoya and García-Peñalvo 2018).

A salient contradiction in the extant literature pertains to the vicious circle that involves researchers being evaluated for publishing in journals that appear in the top quartiles and belong to private business conglomerates. This implies an implicit contract whereby research funding is paid for twice: once by the state and again through subscriptions to access the documents (D'Antonio Maceiras, 2018; Goyanes & Rodríguez-Gómez, 2018; Córdoba-González, 2019). A strong movement has emerged in response to this phenomenon, with some results, but so far, far from being a moral force to counteract the greed of corporate publishers, the reaction has generated new strategies to increase revenue, such as charging publication fees for open access, an issue that has been exacerbated by the mandatory nature of open access for research evaluation since the implementation of the LOSU.

Embracing open science by institutions poses the challenge of making the results, processes and data on which it is based available to the community. However, openness and transparency can benefit the private expropriation of results by monetising open resources. Hence the intermittent flirtation of pharmaceutical companies with open science (Mirowski, 2018), an obvious risk that is important to analyse. Within the framework of current neoliberal policies, which have sought to

weaken universities and the research carried out therein over the last twenty years (De Souza Santos, 2006; AUTHOR, 2014; Diez-Gutiérrez, 2019), we must be vigilant to ensure that the open science proposal does not become another twist of the same policies.

The transparency, authenticity and timeliness offered by open science could reveal the scientific process in real time, allowing claims to be viewed in the context of their underlying data. Open science therefore has the potential to contribute to substantiating relationships that are fundamental to both people's trust in science and science's trust in people (Grand et al., 2012). It is therefore important to carefully analyse the implications that platform capitalism may have for this development. This is no trivial matter, as platform capitalism can appropriate the discourse of open science to pave the way for its ultimate monetisation. The technology platform landscape for science (e.g. Academia.edu, Researchgate and Mendeley) reveals a clear business model that must be dismantled, as at each stage of research it provides external third parties with the capabilities to evaluate, validate, brand and monitor research programmes (Srnicek, 2018). Their nominal 'openness' provides the ideal configuration for near real-time surveillance of the research process — a panopticon of science — which can be exploited and sold in the same way that Facebook or Instagram exploit and sell real-time surveillance of consumer behaviour.

Finally, both science and open education present the challenge of dissemination, seeking to bring science closer to society. This is why citizen science has become one of the eight key priorities of the European Open Science Agenda (2018), alongside the establishment of the European Open Science Cloud (EOSC) (2021). The EOSC facilitates collaboration between multidisciplinary research infrastructures (Otsu and Masó, 2023). The idea is to involve the entire population in a concept of science that provides answers to real problems and needs, and ensures that the results of science are not left in the hands of a few. Therefore, the important question is not who does science, but who it serves. Within this framework, citizen and social innovation laboratories, or medialabs, are gaining momentum as spaces where open science is constructed and disseminated. These labs promote the social construction of knowledge, particularly the generation of new frameworks for understanding and action by epistemic cultures that favour the social and open construction of knowledge (Bradley, 2006). These medialabs open up new avenues for collective work, promoting forms of exchange and relationships that transcend traditional disciplines. This allows for the creation of environments based on the integration of knowledge fields and the formation of diverse communities of practice and emerging pedagogical initiatives. These citizen science practices are linked to educational and training activities, as well as participatory research, and enable the dissemination and transfer of educational research.

1.3. The REUNI+D network. Open science and education: development and activities

Since its inception, the REUNI+D network was created to become a (virtual) space for resources and knowledge to support and promote the work of researchers in the field of educational innovation. It has a track record of more than ten years of uninterrupted work and, in the process, has helped to strengthen the participating groups by demonstrating the value of collaboration for scientific development (Sancho Gil, et. al. 2022). It currently consists of 14 established research groups: ESBINA (University of

Barcelona); PROCIE (University of Malaga); ICUFOP (University of Granada); ELKARRIKERTUZ (University of the Basque Country); EDULLAB (University of La Laguna); EDUDIG and INFORAL (University of Salamanca); STELLAE (University of Santiago de Compostela); GIETE (University of Seville); INDUCT (Complutense University of Madrid); NODO EDUCATIVO (University of Extremadura); CEAEX (University of Valladolid); GLOBAL EDUCATION (University of Cantabria) and IETIC EVEA (University of Oviedo), led by researchers with extensive experience in educational innovation who are highly regarded both nationally and internationally. In total, there are more than 150 researchers involved in the project.

REUNI+D aims to work in line with the Open Science movement by opening up analysis to the implications, contradictions and possibilities it has for the development of research in the contemporary socio-economic context. Since 2019, it has been committed to consolidating a set of actions and procedures that help to deepen the importance of open science and education for the training of researchers and teachers in the field of education. A proposal that aims to respond to the necessary changes in the processes of production, appropriation and distribution of knowledge required by the conditions in which knowledge is produced in contemporary society.

Its work is carried out within the framework of the Networks of Excellence calls promoted by the Ministry of Science, Innovation and Universities. The project, which ran from 2019 to 2022 (RED2018-102439-T), focused on the dissemination of open knowledge and the linking of science with citizens as a first approach to the issue through the analysis of the philosophy, possibilities and problems involved in the open science paradigm, as well as the study of different repositories and platforms for sharing research resources. It also enabled training processes to be initiated for researchers in training within the network teams on the subject matter, as well as on new educational research methodologies.

In the second project, developed between 2023 and 2025 (RED2022-134187-T), the network's main objective was to delve deeper into the field of open science and its connection with citizen laboratories as work environments that stimulate the development of open knowledge through two actions:

The first was to build an open-access repository of educational research objects with data from the research of network members: research tools, data, analyses, reports, etc. *The European OSF repository* (<https://osf.io/hdg4u/>) was selected.

The second has been to take a closer look at the state of the art of citizen laboratories as generators of open knowledge, particularly in the field of education. In addition, seminars have been held to disseminate different experiences of citizen and educational laboratories. The meaning of citizen science and collaborative processes between public universities and the territory has been explored through dialogue with actors from both the local sphere and the global South.

The second objective focused on consolidating the nationally and internationally renowned community of practice and research by promoting synergies between the network's research groups and strengthening collaboration with other national and international networks. To this end, the first action was based on coordinating the network through virtual meetings with the coordinators of each of the groups that make up the network. Another action was a biannual face-to-face

meeting between network members through one of the training activities in which the network has a long tradition: the Summer Schools (summer schools for doctoral students). This strategy provides a face-to-face workspace to monitor the network's work while maintaining a training space on the network's topics and advancing this strategy together with the staff in training in the network's groups.

The second line of action to achieve this objective focuses on promoting R&D&I activities. To this end, a questionnaire was used to map the 14 groups and their active research projects in order to identify the teams available for future R&D&I calls. Two meetings were also held to exchange R&D activities, with presentations and discussions of projects and results.

The third action planned to achieve this objective is the dissemination of scientific output through the incorporation of content into the REUNI+D website (<https://reunid.eu/>), which publishes the activities carried out and a fortnightly blog. Information on the network's scientific output is also kept up to date through the *Dialnet* database and a *YouTube* channel with audiovisual content (<https://www.youtube.com/@reunid686>), in addition to a profile on the X network for the dissemination of scientific output and activities (<https://twitter.com/reunidinv>).

The third objective focuses on promoting connections with related research networks, both nationally and internationally. At the national level, REUNID is an active member of the RETINDE network (<https://www.retinde.es/>) (*Transdisciplinary Network for Educational Research*), which brings together 17 educational research networks and scientific societies in Spain.

At the international level, a white paper on educational innovation research groups in Latin America is being prepared. This approach will enable us to continue establishing working networks and connections with these research teams. This has allowed us to begin a fruitful relationship with the DAI Open Research Data Network, made up of universities in Uruguay, Argentina and Brazil, with which we have held a first seminar within the framework of LACLO 2024 (*Latin-American Conference on Learning Technologies*).

Finally, the fourth objective focuses on training and capacity building for young researchers in open science and educational innovation. To this end, four actions have been carried out. The first is the creation of an internal space for exchange among network members. The second training line of this objective focuses on webinars and seminars in an online format open to the scientific community, both on open knowledge and citizen laboratories and on the projects and research results of the network's research teams.

At the same time, face-to-face workspaces have been maintained to enable young researchers to create a community with the aim of promoting exchanges between young researchers in the network's groups. To this end, an initial approach has been made to the projects and work carried out by each group in order to gain a more accurate idea of the topics currently being developed and to facilitate this exchange of researchers, as well as a meeting between the researchers in training in the network to exchange topics and methodologies currently being implemented, thus enabling a more fluid exchange between the different groups.

2. Methodology

Within the framework of the work carried out in recent years by the REUNI+D network, this text aims to present results on the following objectives:

- a) To investigate the knowledge of the network members about the work carried out in the field of open science.
- b) To recognise the perception that members have of open science and education.
- c) To identify the obstacles encountered by members in advancing open science in higher education institutions.

To explore these three objectives, a mixed research methodology was used, combining a research design that combines quantitative and qualitative data. This methodology is considered appropriate in the case of complex social problems, which require a complex perspective (Sánchez-Escalante et al., 2022). A short questionnaire was designed and administered to all members (the average response time was 10 minutes), which provided access to the information needed to analyse their current situation and make decisions for future plans.

The questionnaire was validated through expert review and modifications were made based on the comments and recommendations provided. It consists of three sections: 1- Descriptive and demographic data (age, length of service at the institution, and level of education); 2- Conceptions and beliefs about open science. Obstacles to its development; 3- Knowledge of and involvement in the activities proposed by REUNID.

It was developed in *Microsoft Forms* with closed and open-ended questions. The former were analysed statistically using SPSS, while the latter underwent content analysis using AtlasTI 9. The validity and reliability of the questionnaire were ensured during the administration process, with a time limit for completion and no repetition of answers by members.

The categories of analysis focused on responding to the three research objectives and can be classified as follows: 1. Concepts and beliefs about open science; 2. Obstacles to the development of open science; 3. Knowledge about open science activities proposed by the network itself.

3. Results

The questionnaire was answered by 58 members of the network (38%) distributed via email, which was answered voluntarily and anonymously. Therefore, it is a consistent and representative sample of the members of the 14 teams. The selection of subjects for the sample was random, so given the high response rate, its representativeness is high. The group has an average age of 45 and 15 years of service at the institution. Most hold a PhD (88%), while 11% are in the process of obtaining one and only 2% are undergraduate students.

When asked about the definition of open science that best matches their beliefs (Figure 1), the three options with the most responses focused on promoting exchange

and collaboration, fostering accessibility, and including the entire research life cycle. Fifteen per cent associated open science with open source software and 5% with free access.

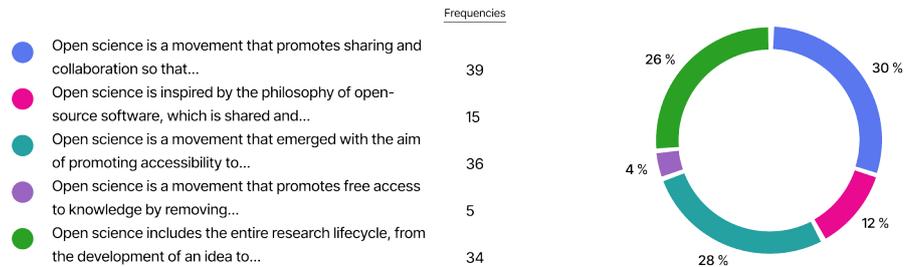


Figure 1. Definitions of open science according to beliefs.

Regarding the benefits of adopting open science (Figure 2), 24% highlight accessibility, 19% public value and integrity, 18% dissemination, and 13% promoting transfer to society.

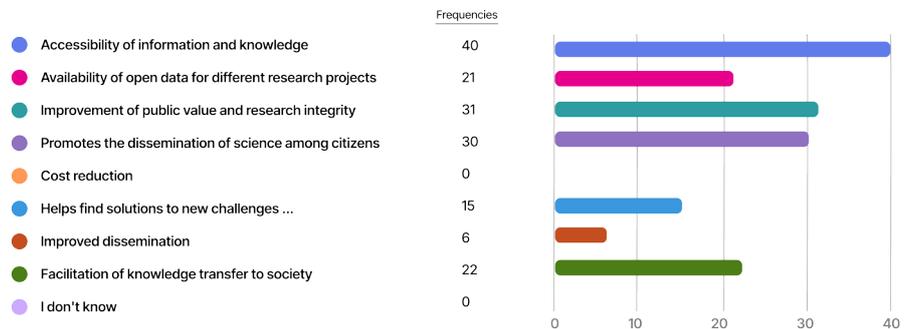


Figure 2. Benefits of adopting open science.

In relation to the difficulties (Figure 3), the contradictions in the evaluation of research stand out as the most important issue, with 23% of responses. Secondly, the lack of clear policies, with 22% of responses, and thirdly, the lack of training for the research community, with 21%. Very few consider fear of copying and fraud or loss of authorship to be a problem.

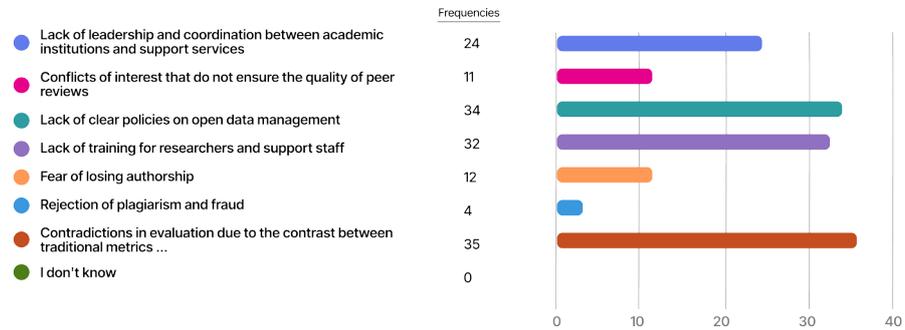


Figure 3. Main difficulties in applying open science.

The open responses were coded using ATLASTI 9 (Figure 4). Thirteen codes emerged from those relating to proposals for addressing difficulties (see Figure 4), among which the most frequent (with 10 mentions) was the need for more training. It is also important to highlight the three Cs (Coherence, Collaboration and Coordination) as a set that brings together the need for institutions to take ownership of this issue and implement policies that can help overcome it. Finally, there is a need for political participation to help drive change by proposing alternatives or manifestos that bring contradictions to light.



Figure 4. Coding open-ended questions and their density.

As for what REUNID can do about this, the majority of respondents emphasised the following: (a) Create small committees to explore specific issues in greater depth. (b) Create codes of good practice. (c) Encourage face-to-face meetings to discuss and share experiences. (d) Encourage the creation of collaborative content with manifestos and joint research projects.

Finally, the level of awareness and participation in the network's activities (Figure 5) among members who responded to the questionnaire is 50%. Only activities related to the dissemination and study of citizen laboratories show a lack of awareness and participation.

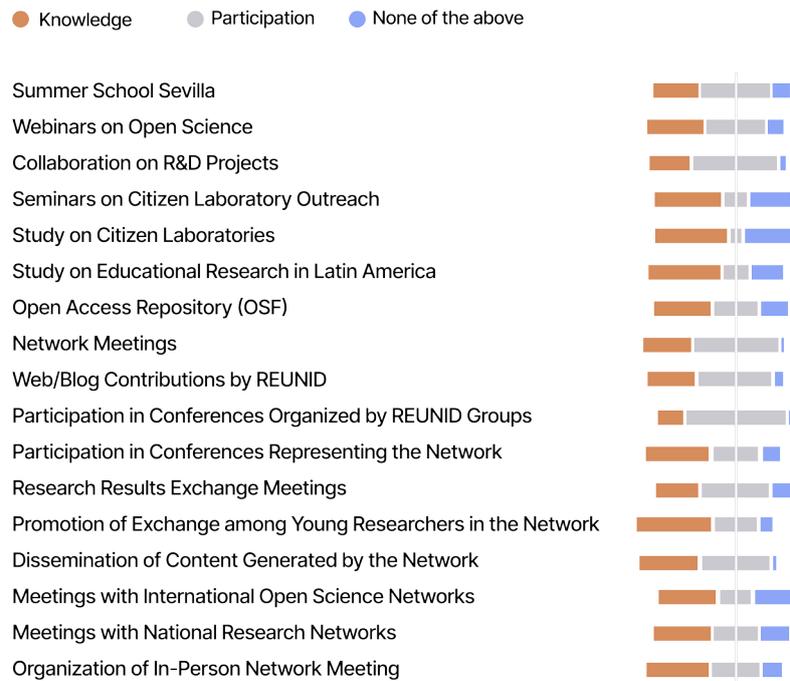


Figure 5. Knowledge and participation in activities carried out in REUNI+D during the period 23-25.

4. Conclusions

The results presented in this article show the work carried out over seven years within the framework of the REUNI+D network, while also serving as an indicator of the current state of open science in Spanish universities. They highlight the difficulties and contradictions we face in addressing the conditions of open science, despite the different regulations currently in force. REUNI+D has launched numerous activities aimed at raising awareness of the issue and encouraging open science practices in which support and cooperation can take place (Sancho Gil et al., 2022).

In this regard, it is clear that, from a conceptual point of view, there is awareness of the meaning of open science and its benefits (da Silveira et al., 2023), as well as the difficulties involved in its application and an ethical commitment to the value of science for the development of citizenship. The members of REUNI+D come from different institutions, each with its own regulations, work cultures and specific micro-political conditions, which also become apparent when defining the difficulties of integrating open science into their research practices, as there are difficulties that point to individual and institutional conditions that are important to identify in order to address them (Scheliga and Friesike 2014). This gives rise to one of the most significant

limitations faced by REUNI+D when defining its objectives. It is no coincidence that the responses with the highest percentage are those that point to contradictions in research evaluation and the lack of clear policies. In this regard, the network project has helped raise awareness of the need for what has been termed in this paper as the three Cs (Coherence, Collaboration and Coordination) as a basic axis for the work to be carried out in each institution (Ramírez-Montoya and García-Peñalvo 2018).

Finally, it is important to note that, despite the limitations of the study in terms of the number of responses obtained, it is noteworthy that 50% of the members are aware of and/or have participated in the network's activities, which is a good indicator. It would be necessary to continue working to ensure that an increasing number of members commit to and integrate the proposals promoted by the network.

As for future lines of research, we believe it would be necessary to supplement these preliminary results with other qualitative data from interviews and discussion groups that would allow for a deeper understanding of the network members' views on open science in a more complex way.

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