ROOTS: Raising Outreach Opportunities and Training for Scientists

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2026

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Internship Report carried out as part of the Master in Cell and Molecular Biology

Department of Biology

2026

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Acknowledgements

ROOTS was a beautiful project born from my love for communicating and for science. This project is the result of many efforts and of many people to whom I owe my thanks.

To my supervision team, Professor Fernando Tavares and Joana Moscoso. To Professor Fernando, for embracing this project and the ideas within it. For the exchange of experiences and advice for my workshop, and for always being willing to help. To Joana, for opening the doors of Native Scientists to me and introducing me to this beloved “home”. Thank you for the right words at the right moments, and for your professionalism that always inspires me to be better. Thank you for never making me feel alone throughout this journey.

To the Native Scientists team, especially Beatriz and Maria, for sharing this experience and for all the hugs (even if sometimes virtual) when needed. For the little pushes at the right time and for the message that always landed perfectly: “You can do it.” To the rest of the team, thank you for the fantastic environment, for the mutual support for each of our individual projects, and for the certainty that we are a wonderful team.

To my Master’s friends, who witnessed the whirlwind of emotions surrounding this report and throughout the course. You were a beautiful gift that the University of Porto gave me. A special thank you to my friends at home, for sharing yet another chapter together.

To Ruben, for another adventure completed side by side. For being a safe harbour, always calm, and for never doubting that I would be capable of doing this.

E para o fim, o mais especial. A minha família. Aos meus pais, que sempre apostaram na nossa educação e apoiaram todos os projetos que foram aparecendo, mesmo que por vezes loucos. Devo-vos tudo o que sou. Aos meus irmãos, que este ano partilham uma coisa especial comigo: somos todos finalistas! Tudo é mais fácil e divertido convosco.

Finally, thank you to everyone who, in one way or another, contributed to the completion of this journey and made everything more beautiful.

Resumo

À medida que a literacia científica é reconhecida como essencial para uma sociedade mais equitativa, Portugal continua a apresentar níveis relativamente baixos. A comunicação de ciência assume, assim, um papel central na aproximação entre ciência, cientistas e sociedade. Contudo, persistem barreiras que limitam o envolvimento de cientistas em atividades de divulgação, e o acesso das crianças à ciência. É neste contexto que a Native Scientists, implementando programas educativos, procura reduzir desigualdades no acesso à ciência.

Este relatório apresenta o projeto *ROOTS: Raising Outreach Opportunities and Training for Scientists* e o meu trabalho enquanto Programme and Training Manager na Native Scientists. Foi desenvolvido como parte do meu plano de Mestrado em Biologia Celular e Molecular. O trabalho integrou quatro componentes: (1) a dinamização da formação "Comunicação de Ciência com Crianças", dirigida a cientistas envolvidos nos programas da Native Scientists; (2) a coordenação e implementação de 21 intervenções do programa Cientista Regressa à Escola em escolas TEIP do Norte de Portugal; (3) a realização de uma intervenção na minha escola primária (do 1º ciclo), onde desempenhei o papel de cientista; e (4) a organização da mesa-redonda "Para Além do Laboratório", dedicada à discussão de percursos alternativos na ciência.

A análise das avaliações recolhidas junto de cientistas, crianças, professores e professoras demonstra elevados níveis de satisfação, aprendizagem e motivação, bem como uma perceção consistente do impacto educativo e social das atividades. A formação contribuiu para aumentar a preparação e confiança de cientistas, enquanto as intervenções promoveram interações significativas que reforçaram a proximidade à das crianças à ciência. A mesa-redonda revelou desafios persistentes na integração da comunicação de ciência na formação académica e nas estruturas institucionais, e destacou a necessidade de oportunidades de comunicação de ciência para estudantes e investigadores que procuram carreiras alternativas ao laboratório. O relatório conclui com uma reflexão sobre o contributo destas iniciativas para a promoção da equidade no acesso à ciência e para o fortalecimento das competências de comunicação dos participantes.

Palavras-chave: comunicação de ciência, literacia científica, envolvimento de crianças na ciência, formação de cientistas, implementação de oficinas, impacto social, carreiras alternativas em ciência

Abstract

As scientific literacy is increasingly recognised as essential for a more equitable society, Portugal continues to show comparatively low levels in this domain. Science communication has therefore become a key strategy to promote meaningful engagement with science. Despite evidence showing benefits for both children and scientists, structural barriers continue to limit scientists' participation in outreach, while many children, particularly those in socioeconomically vulnerable contexts, face reduced access to science. It is within this landscape that Native Scientists implements programmes designed to reduce inequalities in access to science.

This report presents the project *ROOTS: Raising Outreach Opportunities and Training for Scientists*, and my work as Programme and Training Manager at Native Scientists. This was developed as part of my Master's plan in Cell and Molecular Biology. The work comprised four components: (1) the delivery of the training session "Science Communication with Children" to scientists participating in Native Scientists programmes; (2) the coordination and implementation of 21 workshops for the Same Home Town programme in TEIP schools across Northern Portugal; (3) the implementation of a workshop in my primary school, where I was the scientist; and (4) the organisation of the round table "Para Além do Laboratório", focused on professional pathways in science communication.

Feedback collected from scientists, teachers and children indicates high levels of satisfaction, learning and motivation, as well as a consistent perception of the educational and social impact of the activities. The results show that the training session enhanced scientists' preparedness and confidence, while the workshops fostered meaningful interactions between children and scientists, strengthening scientific literacy and promoting a sense of proximity to science. The round table discussions highlighted persistent challenges in integrating science communication into academic training and institutional structures, while also revealing the need for science communication opportunities for students and researchers seeking careers beyond the laboratory. The report concludes with a reflection on the contribution of these initiatives to promoting equity in access to science, strengthening participants' communication skills, and supporting professional development.

Keywords: science communication, scientific literacy, children's science engagement, scientist training, workshop implementation, social impact, alternative science careers

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List of Abbreviations

DGE	DIRECTORATE-GENERAL FOR EDUCATION
EB	ESCOLA BÁSICA
FCUP	FACULTY OF SCIENCES OF THE UNIVERSITY OF PORTO
NATIVE	NATIVE SCIENTISTS
OECD	ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT
PISA	PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT
SCTA	SCIENCE CAPITAL TEACHING APPROACH
SDG	SUSTAINABLE DEVELOPMENT GOALS
SHLIL	SCIENCE AND HERITAGE LANGUAGE INTEGRATED LEARNING
SHT / CRE	SAME HOME TOWN / CIENTISTA REGRESSA À ESCOLA
SMC	SAME MIGRANT COMMUNITY
TEIP	TERRITÓRIOS EDUCATIVOS DE INTERVENÇÃO PRIORITÁRIA
UP	UNIVERSITY OF PORTO

Chapter 1: Introduction

1.1. Scientific Literacy and Science Communication

Scientific Literacy is a concept that has been appearing in literature in the last few decades, with multiple interpretations (Laugksch, 2000; Rudolph, 2024). Although definitions may vary, they tend to converge in one similar idea: scientific literacy is the public understanding of science. The debate diverges from this point on. While some scientists emphasise scientific literacy primarily as a means of correcting society's deficiencies in scientific knowledge, others adopt a broader concept centred on the usefulness of science to society (Valladares, 2021). More recently, the Organisation for Economic Co-operation and Development (OECD) defined it as "the ability of an individual to engage in science-related issues and to understand scientific ideas as a reflective citizen being able to explain phenomena scientifically, evaluate and design scientific investigations, interpret data and evidence scientifically" (OECD, 2019, p. 101). This definition seems to integrate both dimensions, strengthening the concept.

The truth is that scientific literacy is being increasingly recognised as essential for individual development and societal progress. Sharon and Baram-Tsabari (2020) even add that it serves as a cornerstone for building a more cohesive, fair and participative society. Yet, despite this recognition, recent studies highlight persistently low levels of basic scientific skills among the Portuguese students. The Programme for International Student Assessment (PISA) in 2022 reported that 29,7% of Portuguese 15-year-olds failed to reach minimum proficiency in mathematics, while TIMMS 2023 placed Portugal last among the participating EU countries in science and maths performance, with outcomes strongly shaped by socio-economic background (IAVE, 2023; OECD, 2023; von Davier et al., 2024). In an era where scientific knowledge is increasing at an unprecedented speed, the distance between experts and the public is becoming increasingly visible. Scientific literacy helps reduce this gap by creating bridges between science and society (Süerdem & Çağlıyor, 2016). Empowering citizens to understand and to be interested in science is essential for preparing critical and informed individuals who can navigate the challenges of an ever-evolving society (Roche et al., 2023). In fact, international evidence shows that countries with higher levels of scientific literacy, such as Finland and Japan, tend to display greater economic prosperity and stronger innovation capacity. Moreover, national scientific performance and society's scientific culture are directly associated with economic competitiveness and socioeconomic development (Ustun, 2024; Abramo & D'Angelo, 2024).

Strengthening scientific literacy also reinforces democratic participation. Informed people are better equipped to make decisions based on science about issues such as health, environment, and technology, either at a personal or societal level, without simply accepting the underlying status quo (Yacoubian, 2017). Addressing these inequalities demands approaches that promote broader engagement with scientific knowledge.

In this context, science communication has gained prominence as a crucial mechanism for enhancing scientific literacy. This concept, similarly to the previous one, lacks an exact and universal definition. Recent research argues that science communication extends beyond the simple transfer of knowledge from scientists to lay audiences; it involves reciprocal interaction with the public and constitutes an established area of study and professional practice (Roche et al., 2023). Historically, science communication was often applied through a “deficit model”, which assumed that the public lacked knowledge and that a one-way transmission of information from experts to lay audiences was the solution (Simis et al., 2016). This perspective has been increasingly criticised for overlooking people’s needs, values and prior knowledge (Bucchi & Trench, 2021). More recent approaches defend a “dialogue” or “participatory” model, in which scientists and citizens engage in two-way interactions, co-produce knowledge and jointly reflect on the social implications of science. An example of this is citizen science, in which diverse audiences are directly and actively involved with scientists’ research, through projects or other initiatives. Through their involvement in real scientific studies, citizens help decode scientific problems and generate valuable data (Haklay et al., 2021). This participation strengthens citizens’ motivation and interest in science, increases trust and enhances their understanding of scientific subjects. At the same time, scientists benefit from access to large and diverse data sets that support the advancement of their research (Finger et al., 2023).

In conclusion, for social, economic, and political development, society relies on science, and scientists depend on the interest, resources, and talent provided by the public (Jucan & Jucan, 2014). For this relationship to function effectively, communication between these two entities must be reciprocal: when presenting their findings and work to the audience, scientists must be open to integrate people’s needs and considerations. Ultimately, there is a need for citizen science and science communication. Together they enhance public access to scientific knowledge and strengthen individuals’ capacity to participate meaningfully in decision-making processes (Roche et al., 2023).

1.2. Scientists' involvement in science communication

We live in a time marked by unique and important discoveries, yet the pace of discovery is not matched by an equivalent effort to communicate these findings to society. As a result, science communication and public outreach have become increasingly important (Hunter, 2016). Scientists and scientific institutions now face the challenge of disseminating science in an accessible and inclusive way to educate communities about the uncertainty of science, so that the rise of misconceptions and misinformation doesn't continue to increase. These misunderstandings often rise from the highly specialised nature of scientific language, which can feel disconnected from the audience's reality, combined with low levels of scientific literacy that have contributed to a decline in public trust (Navalhas, 2025). A meaningful and sustained interaction between scientists and diverse audiences is therefore essential, and science outreach activities offer an effective way to foster this connection.

When scientists participate in engagement activities, their motivations are varied. According to Bento, these can be grouped into societal and personal motives (Bento et al., 2023). Societal motives reflect the desire and the expectation to have an impact on others and make a meaningful difference in people's lives. On a personal level, engagement activities can help scientists develop transversal skills, such as public speaking, adapting language to different audiences, as well as teamwork and leadership (Illingworth & Roop, 2015). Moreover, teaching and explaining scientific concepts to broader audiences improved researchers' methodological and analytical skills, and it was correlated with higher rates of publication (Feldon et al., 2011). Many scientists feel good about sharing their work, and some even argue that science communication should be an integral part of scientific training (Hunter, 2016).

However, scientists' participation in scientific activities is sometimes constrained by a lack of time, weak or non-existent incentives, and limited training (Calice et al., 2022; Riley et al., 2022). At the institutional level, science outreach is being portrayed as part of their third mission, with policies, metrics and partnerships to enhance social impact and make engagement a normal expectation, especially for students and early career researchers (Compagnucci & Spigarelli, 2020). Despite the efforts being made, studies in European and UK universities highlight the lack of investments, incentives and training opportunities for third mission activities and the need for a more diverse audience (Spânu et al., 2024).

Ultimately, engaging in science outreach activities is mutually beneficial. On one hand, scientists provide a valuable public service by offering clear, accurate information and

helping strengthen scientific literacy. On the other hand, they gain opportunities to deepen their own understanding, share their enthusiasm for the field, develop communication skills, and build networks with diverse communities and institutions that can support their future work. Over time, these interactions contribute to a more empowered society, promoting trust in research and encouraging evidence-based decision-making. Realising this potential, however, depends on creating environments where engagement is supported, recognised and meaningfully integrated into academic life.

1.3. Science enrichment activities in primary schools for equity in education

Children are a fountain of curiosity, and their ability to learn new information is increased by direct exploration and experimentation (Yilmaz et al., 2024). During the early stages of life, scientific activities can help spark interest in science, amplify its understanding, and enhance social and cognitive development (Carballido et al., 2024; O'Connor et al., 2021). Children build knowledge by asking questions about their surrounding world, and scientific conversations contribute to nourishing their interest in scientific topics. A study in India revealed that scientific activities, besides providing hands-on experience, also enhance children's intellectual curiosity and scientific behaviour, and it seems to strengthen children's self-confidence to learn and pursue scientific careers (Sowmya & Rani, 2025).

The need to promote science activities becomes even more evident considering scientific evidence showing a decline in interest for science at the ages of 10 to 14 (Archer et al., 2013; Steidtmann et al., 2023). This is particularly alarming as we are also witnessing decreasing performance in science and mathematics among Portuguese students, as well as a reduced capacity for reflection and problem-solving (IAVE, 2023; OECD, 2024). Several factors contribute to this pattern. One of them is the persistent presence of stereotypical images and representations of scientists, often portrayed as white men with spiky hair and explosive laboratories. This not only misrepresents scientific work but also reinforces gendered and cultural expectations. According to research, even the physical environment surrounding children can influence their perspectives of who "belongs" to science: stereotypically masculine objects in a classroom are enough to reduce girls' interest, whereas neutral environments eliminate this gender gap (Cheryan et al., 2009). As a result, girls, more than boys, are less likely to see themselves pursuing a scientific career, even if they believe they can become scientists (Gauthier et al., 2017).

Besides, cultural diversity, social class, and ethnicity further shape children's engagement with science. Children from underserved communities often encounter fewer opportunities for hands-on scientific exploration and may face subtle messages that science is a field for "others" (Keith & Griffiths, 2021). Limited access to relatable role models is both a component and a consequence of these structural inequalities. The absence of scientists who reflect children's backgrounds can restrict their confidence, aspirations, and sense of belonging in science, while simultaneously reinforcing the very disparities that limit such representation. Geographical contexts further amplify these disparities: in rural areas, limited access to scientific resources and extracurricular programmes creates a significant gap in these children's future aspirations compared to children living in urban areas (Archer et al., 2012; von Davier et al., 2024). Together, these factors contribute to a cumulative disadvantage that affects not only interest but also long-term participation in scientific pathways.

It is therefore essential to promote and implement scientific activities that allow children to explore science practically and dynamically, while also ensuring that these opportunities reach children from underserved communities. As Sowmya and Rani (2025) emphasise, "when underprivileged children are provided with learning opportunities and resources, we can enhance the quality of their education."

In Portugal, an initiative called TEIP (Priority Intervention Educational Territories or Territórios Educativos de Intervenção Prioritária) was created by the Directorate-General for Education (DGE), to support schools located in economically and socially disadvantaged areas. Its main goals are the prevention and reduction of early school abandonment and absenteeism, as well as the promotion of educational success for all students. The creation of this initiative highlights the national commitment to promote equitable education to all children, regardless of their background. Within this framework, TEIP schools drive educational projects and activities tailored to the specific needs of their communities and designed in collaboration with a wide network of partners, such as teachers, students, local municipalities, and cultural associations (Despacho nº 147/B/ME/96, Despacho nº 55/2008, Despacho nº 20/2012, Despacho n. º 7798/2023). These projects aim to improve student achievement, diversify learning pathways, promote safety and prevent violence, and foster close cooperation with families and the community to support lifelong and local development.

Sustaining children's interest in science goes beyond science activities. It requires creating an inclusive environment where all children feel like they belong. Because stereotypes, gendered cues and social or cultural inequalities can limit who sees science

as “for them,” expanding access to hands-on and welcoming science experiences is essential to ensure that every child has the chance to explore their curiosity and imagine a future in science.

1.4. Native Scientists and the programmes

Native Scientists (Native) is a non-profit organisation founded in 2013 by two Portuguese scientists, Joana Moscoso and Tatiana Correira, who were themselves scientists at that time. The passion for science and communication, combined with their awareness of inequalities regarding science access, led these two scientists to create Native. Aware of the different educational challenges that migrant children face, they understood they could bridge the gap between these children and science by connecting them with scientists in meaningful activities. Importantly, these scientists are not random volunteers, they share a common language, cultural background, or place of origin with children, which allows them to act as relatable role models for children. This shared identity is fundamental to the programmes’ design, as it strengthens children’s sense of belonging and challenges the perception that science is “for others”. Native is, therefore, the product of these efforts to create and implement educational programmes that connect children and scientists with the same background. This includes the Same Migrant Community (SMC) and the Same Home Town (SHT), referred to as *Cientista Regressa à Escola* (CRE) in Portuguese.

Since 2021, Native has also been active in Portugal. Its two educational programmes are spread through European countries, and its mission is to combat inequalities in access to science, promoting inclusion, scientific literacy and the valorisation of heritage languages. Based on strong values, Native is committed to the Sustainable Development Goals (SDGs) and the priorities of the European Union. Aligned with Goal 4, Native wants to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Through the Same Home Town programme, which connects children and scientists who studied in the same primary school, children are provided with access to new and dynamic learning opportunities. This approach is also aligned with Goal 10, reducing inequality within and among countries, as Native actively works to bring science to communities that traditionally have fewer opportunities to engage with it. By implementing the programmes in rural areas and regions with limited access to science, the organisation contributes to reducing educational inequalities. Through meaningful connections between children and scientists who share a common background, Native seeks to broaden children’s horizons, bridge the gap between children and science, and bring them closer to future opportunities. Native’s commitment

with these goals doesn't end here. The organisation actively collaborates with schools, municipalities, universities and other stakeholders to maximise the reach and long-term impact of its mission, consolidation goal 17, Partnerships for the Goals). In addition, by encouraging the participation of women scientists and positioning them as a visible role model for children, especially girls, Native promotes gender equality and empowerment for all women and girls, aligned with Goal 4.It is with these strong pillars in mind that Native believes in a future where every child can reach their full potential, regardless of their background.

Since its creation and throughout these last 13 years, Native Scientists has established close to 40,000 connections between children and scientists. This is possible due to partnerships with universities and research institutes that create opportunities so that scientists from different areas can be involved directly with the community, prompting scientific literacy but also inclusion.

Internally, Native Scientists is organised into six fundamental departments: Communication, Marketing and Events; Programmes and Projects, the one that I was inserted into; Consolidation and Development; Finances and Legal Affairs; Strategy, Data and Talent; and Impact and Research. Even though all these departments have specific functions, they are all connected and work together to bring science to children.

The Same Migrant Community was Native Scientists' first educational programme. It takes place in several European countries, where scientists who share the same heritage language with children carry out pedagogical and interactive science workshops.

This programme targets mostly migrant children due to the lack of access to science these children have. According to the literature, one in five children in Europe has a migrant background (OECD, 2025) and they are twice more likely to underachieve in school compared to their non-migrant peers (Seynhaeve et al., 2024). Multiple factors account for this educational inequality, such as the lack of school support in heritage language learning and multilingualism, which is known to affect migrant children's academic performance and sense of belonging (Cummins, 2008; Cerna et al., 2021). In addition, lower levels of well-being and belonging, together with subtle forms of prejudice and preconceptions about different cultural backgrounds, further shape children's engagement with school (Gillborn, 2015). These structural inequalities continue to limit confidence, aspirations, and access to equitable learning opportunities (Eurydice European Education and Culture Executive Agency, 2019).

The main goal of this programme is therefore to connect children and scientists and to reinforce their sense of belonging and cultural identity through communication in the same heritage language, which is crucial to social inclusion.

The programme's methodology incorporates key aspects of the theory of Science Capital Teaching Approach (SCTA), and the Science and Heritage Language Integrated Learning (SHLIL) approach. Science capital represents the sum of all science-related experiences, conversations and knowledge a person accumulates over time, which varies widely depending on opportunities, family background, school experiences and cultural context (Archer et al., 2015). Developed by Professor Louise Archer and colleagues in 2015, as part of the ASPIRES project, a longitudinal research project studying young people's science and career aspirations, it was designed to explain the persistent differences in their aspirations (Archer Ker et al., 2013). The Science Capital Teaching Approach (SCTA) was therefore created by the mutual efforts of scientists and primary school teachers to support underserved children in their journey towards science (Nag Chowdhuri et al., 2022). The focus is for children to create meaningful and closer connections with science, to build a more human and truthful image of science and scientists, where they are co-creators of knowledge, by interacting with science professionals. In the Same Migrant Community programme, by valuing children's linguistic and cultural assets, SCTA is being applied. By connecting them with scientists who share their heritage language, the SMC programme strengthens their sense of belonging in science and supports the development of their science capital.

When it comes to SHLIL, a variation from the Content and Language Integrated Learning (CLIL) approach, where students learn new content through a foreign language from a range of disciplines (Coyle et al., 2010), children learn specifically about STEM disciplines through their heritage language (Schiefer et al., 2024). SHLIL portrays science learning as an experience shaped by language and identity, where children explore scientific concepts in their heritage language while taking part in hand-on activities carried out by scientists who share similar cultural and migration backgrounds. The goal is to spark children's interest in studying science subjects and to support their heritage language development, helping them feel that science is also "for people like me".

In the SMC programme, there are four steps of interaction. In the first step, children complete a worksheet to better prepare them for the workshops, and scientists receive training in Science Communication with Children. During the workshop, the children carry out the activities organised by scientists and, after the workshop, they consolidate what

they have learnt through a post-workshop worksheet. At the end of the school year, the children take part in the European-wide contest, and the impact is assessed using the pre- and post-workshop sheets.

Since its beginning in 2013, 14 countries have received this programme, reaching over seven thousand children and involving more than a thousand scientists. This programme is effective because children are participating in exciting activities held in their heritage language, encouraging them to science and to learn new words in this language.

The Same Home Town is the most recent Native Scientists' programme, and it was launched in Portugal in 2021 by Joana Moscoso, Joana Bordalo, and Matilde Gonçalves. In this programme, scientists return to their primary school or hometown and carry out science activities with children in the fourth grade. The programme relies on three concepts: Relational Education, the Science Capital Teaching Approach, and Native's concept of Circular Education. Its core aim is to ensure that every child meets a scientist from their hometown who shares their regional accent and can inspire them towards science.

Relational Education is a concept which centres the human connection in the learning process (Hickey & Riddle, 2023). It recognises that students and teachers exist within a complex network of relations that shapes how learning unfolds (Hickey et al., 2021). Rather than a traditional, transmission-based model, where students play a passive role in the learning process, it proposes a more inclusive, engaged and participatory approach to teaching, one that prioritises education as something co-constructed through interaction (Moll, 2019). In the SHT programme, the relational connection becomes especially meaningful. Children connect more easily with the scientists because they share a common background, making this interaction more impactful. This sense of belonging strengthens the interaction and the learning process, allowing children to see science as something closer to their own lives.

The concept of Circular Education is based on the idea of giving back to our community. This innovative concept, inspired by Circular Economy and the circularity of knowledge and contribution, is set in the idea of giving back to our communities, the place where we were born and raised, where our education started. The implementation of this concept through an educational programme allows Native Scientists to reach children with less access to science and less access to educational activities. Native helps transform vicious circles into virtuous circles by connecting children with someone they can relate

to, since they came from the same social and cultural background. When scientists return to their communities, they spark conversations about science across the whole region, and the programme brings together teachers, local authorities, the media, and families, ultimately making science feel closer and more accessible to society. In these workshops, the connection between local children and local scientists is essential. It aims to strengthen children's confidence in science, nurture key skills such as curiosity and critical thinking, and reinforce the idea that science is truly for everyone. The activities help dismantle stereotypes about science ("very hard" or "only for geniuses") and scientists ("crazy men in lab coats"), encouraging children to think, "If I want to, I can become a scientist."

This programme, in similarity with the previous one, has more than one step, specifically five. Scientists receive Science Communication training, and children complete the pre- and post- workshop sheet before and after the activities that the scientists organise. The main difference is the presence of an extra step: the *Caderneta de Cientistas*. This sticker book is sent to every school participating in our programme, and children use it to play a matching game, where they connect each scientist to their hobbies, passions, and region of origin. It gives children an opportunity to explore the geography of our country, discover the different scientific fields, and get to know all the diverse scientists participating in the programme. It is also an opportunity to give visibility to the participating scientists in our programme and their work.

As the programme reaches its fifth year in 2025/2026, Native reports its expansion to 117 municipalities, connecting more than 13 thousand children and 350 scientists. This impact reflects their commitment to their big goal of making Portugal the first country in the world where no child transits for the 5th grade without having met a scientist from their own hometown.

1.5. The ROOTS project

This is the report of the project ROOTS: Raising Outreach Opportunities and Training for Scientists. It shares my experience as Programme and Training Manager at Native Scientists, with particular focus on the activities developed and their impact. In this role, I was responsible for delivering the training session "Science Communication with Children" for both Native's programmes, managing the implementation of 21 workshops of SHT in TEIP schools in the North of Portugal, and organising an additional workshop in my primary school, where I was the scientist. Together with my supervisors, we hosted the round table "Para Além do Laboratório", in the auditorium of the Faculty of Sciences of the University of Porto. The event was open to all, but its main target audience were

university students, and its purpose was to give visibility to alternative professional pathways in science beyond the laboratory.

The following chapters present the methodological approach and outcomes of these activities. First, I describe the structure and implementation of the training session and the SHT interventions. This is followed by an analysis of the feedback collected from participating scientists, children, and teachers, as well as a summary of the main themes discussed during the round table. Finally, the report concludes with a reflection on the overall significance of these activities for the communities involved and for my own professional development.

Chapter 2: Methodology

The methodology of the work carried out during the project ROOTS was structured around four main processes: the delivery of training sessions for scientists, the implementation of an educational programme in schools, the organisation of one workshop in my primary school, and the coordination of the public event “Para Além do Laboratório”. Together, these components describe the practical steps, collaborative processes, and pedagogical considerations that guided the activities of this work.

2.1. Delivery of the training session “Science Communication with children”

When scientists agree to participate in both Native Scientists’ educational programmes, they are invited to attend a training session in Science Communication with children. During the school year of 2025/2026, I was responsible for delivering these training sessions. Each session was held online, usually lasted around 90 minutes, and aimed to prepare scientists for delivering a hands-on and interactive workshop. Although time was limited for extended individual contributions, the sessions were designed to be dynamic and participatory, using interactive elements, such as polls and short reflection prompts.



Figure 1. Introductory slide from the training session.

The slide presents the purpose of the training and the topics covered.

The training covered a range of different topics, beginning with the core values of Native Scientists and concluding with practical tips for effective engagement, as shown in Figure 1. The training session would start with a brief presentation about both the trainer and the scientists, followed by an overview of the organisation. This includes the motivations behind the creation of Native Scientists and the reason for working with children from the 4th grade, as mentioned in the previous chapter. The methodology and structure of the programmes were presented as well, closing the introductory section. This section was personalised, depending on the programme the attending scientists were participating in.

The following section focused on the scientists' outreach project. We would start by giving key recommendations for workshop delivery, such as promoting dialogue and a positive interaction with the children, talking about their careers with passion, and bringing support materials. This was complemented by concrete examples of materials and activities used in past workshops. That section included a proposed structure for the workshop, as well as the most important tip: defining the main message of the intervention, which would serve as the core for the activities.

Section 3 focused on effective communication with children, structured around six practical tips. We began by emphasising the importance of connecting with children by being mindful of their ages, cultural identity and experiences. We encouraged scientists to share their own feelings, whether nervous because it was their first time, or excited because they are doing something that they love, to build a stronger connection. Then we highlighted the use of short, clear sentences with no jargon, meaning those technical words that are specific to each area. Through examples, we explored how to simplify research topics by returning to the basics of their work and recalling what got them interested in the first place. The third tip focused on relating the content to the audience, using parallels between what scientists use in their investigations and how they relate to real examples that children use in their daily lives. Next, we discussed how to plan activities that foster children's participation, using materials, questions, or even examples to facilitate their engagement. This led to discussing the difference between simplifying and infantilising, reinforcing the idea that children would understand complex ideas if scientists used real-life examples, and there is no need to exaggerate concepts to make them memorable. The final tip was to activate children's prior knowledge and foster curiosity, beginning their interventions with concepts they already know to spark curiosity and build confidence. With this, we finished the section of tips for effective communication.

To support scientists in preparing their sessions, we introduced the Workshop Preparation Board, a tool developed by the Native Scientists team to facilitate this process. By filling out a form, scientists receive a document where they would have the most important information for their workshop, which would be divided into four guiding questions: “Who do I want to reach and how?”, “What message do I want to pass on?”, “What do I need to make it happen?” and “What will I do?”. After presenting the board, we saw some examples of past activities and how scientists structured their workshops.

We then discussed strategies to disseminate the scientists' work during or after their workshops. We encouraged sharing on their social media, adding the experience to LinkedIn, or even sharing in conferences and lab meetings.

The Health and Safety section covered recommendations for using breakable, live, genetically modified or allergenic materials, as well as some notes on how to deal if a child is upset or being unruly. We also presented the safeguarding and privacy policies to ensure the protection of both children and scientists.

The final section offered a brief overview of the programmes’ impact. We presented the results to date, a map of countries or cities where the programmes had happened, and key indicators of quality of implementation.

We concluded with a time for Questions and Answers, inviting scientists to raise any questions they might have.

Throughout the training, scientists were encouraged to participate by answering questions where they would share their experience, such as if they were exposed to science while growing up, or if they had talked about their work to a class of children before.

Once the training was finished, scientists received all materials used during the session, along with a feedback form that was used to measure the impact the training had on scientists.

Although the training had been implemented in previous years, during my internship, and with the help of the team, I redesigned the session structure to make it more engaging, interactive, and easier to follow for participating scientists.

2.2. Implementation of the educational programme

The implementation of the Same Hometown programme was organised into three phases: Explore and Explain, Engage and Deliver, and End and Endorse, Figure 2. These phases were designed to simplify and optimise the delivery of each workshop.

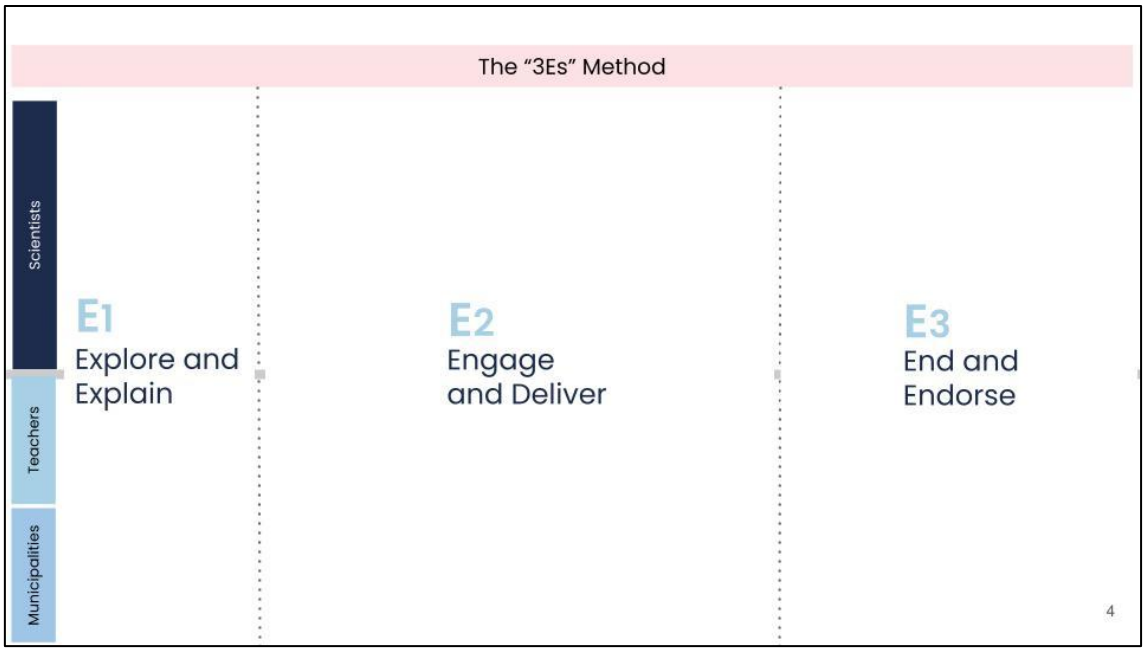


Figure 2. Diagram of the "3Es" Method.

The slide illustrates the three phases of programme implementation: Explore and Explain, Engage and Deliver, and End and Endorse.

In the first phase, Explore and Explain, the pairing between scientists and schools was carried out. Municipalities were first classified according to Native Scientists' priority criteria. A municipality was considered "priority" if it met one of the following conditions: (1) the presence of TEIP schools, (2) negative equity indicators, (3) population density equal to or below 100 inhabitants per km2. Negative equity indicators refer to how the academic results of students in vulnerable socioeconomic conditions compare with national results for students with similar profiles (DGEEC, 2022). Municipalities meeting more than one criterion, as well as those located on the islands, were classified as "super-priority". Within each selected municipality, TEIP schools were then identified and prioritised for the pairing process. We then searched our database for scientists who had studied in those schools and expressed interest in participating in the programme. After identifying potential pairings, an invitation to the scientists was sent, and after receiving their confirmation and completed registration form for the workshop, we would contact the school. During these calls, we presented and explained the programme, followed by validation via email. After the school agreed to participate, we reviewed the availability indicated by the scientists in their forms and coordinated with the teachers to identify one suitable date for the workshop. Once both parties had confirmed the workshop date, the next step involved finalising the timetable for the day. We would then contact the municipality, and the process moved to the following step.

The second phase, Engage and Deliver, focused on ensuring that all stakeholders were adequately prepared and that the workshop could be implemented smoothly. Communication during this phase involved three main groups: scientists, teachers and municipalities. For the scientists, it was essential to confirm their attendance in the training session and provide support with any questions that arose. One month before the workshop, they received the timetable, the classes' composition and the Workshop Preparation board, as mentioned in the section "Deliver Trainings in Science Communication with Children". Two weeks before the workshop, a follow-up email encouraged them to present their favourite childhood book during the workshop, to promote reading. They were also reminded to encourage children to complete the feedback sheets after the workshop, which are essential for impact measurement. Lastly, scientists were invited to bring a colleague, a family member, or a friend to accompany them on the day.

For teachers, the data and image consent forms and the pre-workshop sheets were sent one month before the workshop, to allow time for printing and distribution. Consent forms were signed by legal guardians, and the pre-workshop sheets were implemented by the teachers with the children, including one question to be answered together with their families. Two weeks before the workshop, teachers received additional recommendations, including supporting scientists in collecting feedback from children and confirming the arrival of the kit. The kit, sent to schools in advance, contained children's feedback sheets and participation certificates. Teachers also received a tote bag, and scientists were provided with a Native Scientists' t-shirt. On the day before the workshop, teachers were contacted to ensure that all consents were filled out and that preparations were in place.

Finally, municipalities were invited to attend the workshop and to photograph the activities. For this purpose, we provided photo guidelines together with the audiovisual consent form.

Due to operational constraints, given that workshops take place across several cities, it is not feasible for the team to be present at every workshop. Nevertheless, I was able to attend two workshops during the internship period, besides my own.

The workshop day marked the conclusion of the second phase and, with the start of the following day, the beginning of the third and final phase.

The End and Endorse phase consisted of thanking all stakeholders and collecting the materials required for impact assessment. After the workshop, an email was sent to the

scientists, teachers, and municipalities. Scientists received a message thanking them for participating, requesting a picture of the completed feedback sheets, and inviting them to share their own feedback. Teachers were asked to implement the post-workshop sheets and to send all the materials (pre- and post-workshop sheets and consents) either digitally or through another agreed method. These documents formed the basis of the programme's impact measurement. Municipalities were thanked for their involvement and asked to share the photographs taken during the workshop. These images were then shared with both scientists and teachers.

The workflow described above is synthesised in Figure 3, which visually summarises the key steps and interactions involved in the implementation process.

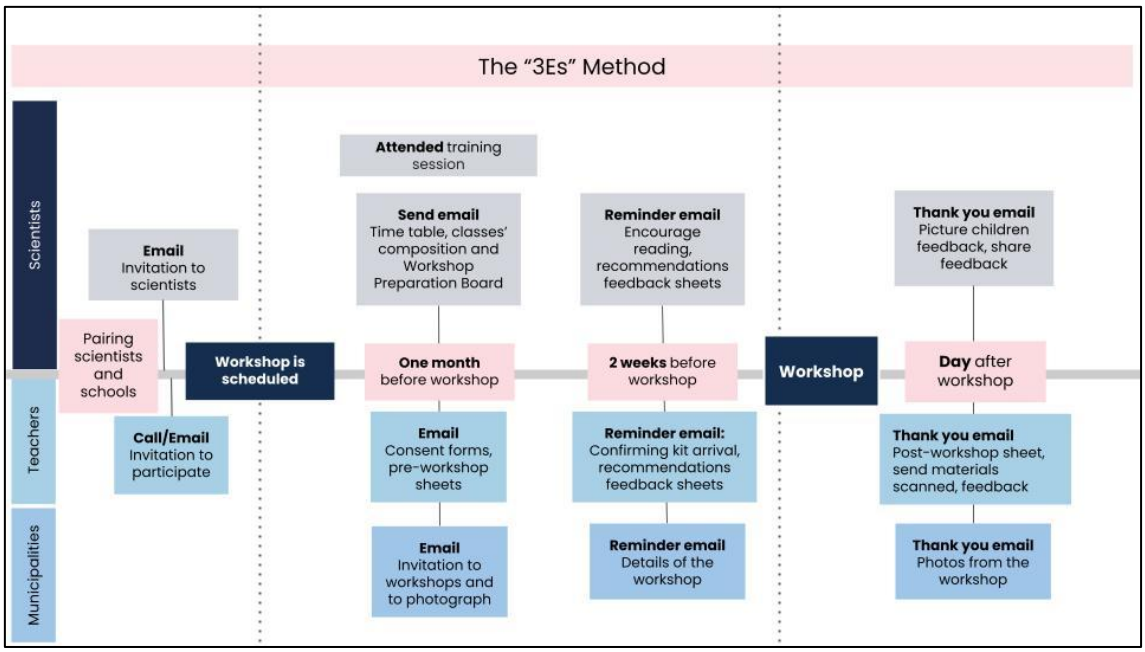


Figure 3. Chronogram of the "3Es" Method.

This slide details the sequence of communications and tasks carried out with scientists, teachers, and municipalities before, during, and after the workshop.

Following this, we ensured that all necessary materials were archived, including photographs, consent forms, pre- and post-workshop sheets and any media coverage related to the workshops.

At the end of the school year, around May, we began sending the *Caderneta de Cientistas* to all participating schools. This booklet, designed by our Communication Team, required verification of scientists' information and confirmation of the schools' addresses. Teachers were contacted to confirm receipt of the booklet and were invited

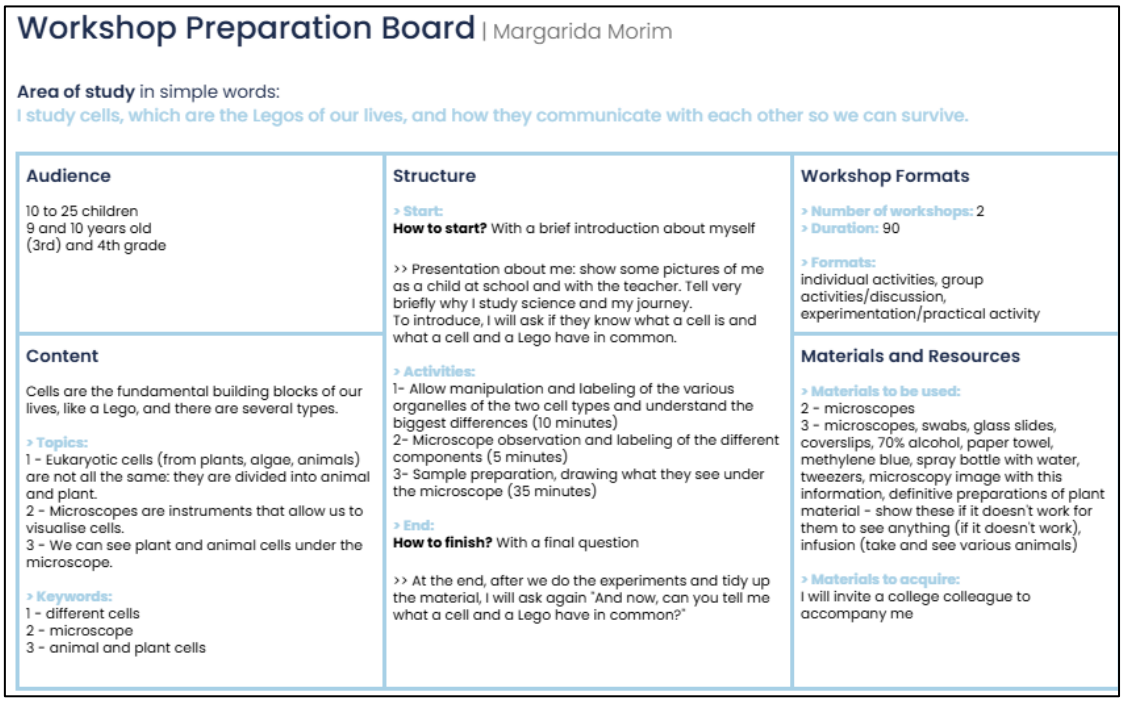
to share photographs of students completing the activities. Once received, these photographs were added to the workshop's archive.

2.3. Organisation of a workshop in my primary school

The workshop implemented in my primary school took place on 10th of December and required both theoretical and practical preparation. This activity was part of the Same Home Town workshops and followed the methodological principles included in the training sessions described 2.1.

The first stage consisted of establishing contact with my former primary school to invite them to participate in the programme. After confirming, a date was scheduled, and an official invitation was subsequently extended to the Municipality of Póvoa de Varzim.

After these confirmations, the workshop creation process began. The initial task was to define the main message. Given my academic background in Cell and Molecular Biology, the topic of cells was selected, framed through the main message "Cells: the Legos of our Lives". This metaphor served as an accessible anchor point for children to understand the biological organisation.



Workshop Preparation Board | Margarida Morim

Area of study in simple words:
I study cells, which are the Legos of our lives, and how they communicate with each other so we can survive.

Audience

10 to 25 children
9 and 10 years old
(3rd) and 4th grade

Content

Cells are the fundamental building blocks of our lives, like a Lego, and there are several types.

› Topics:
1 - Eukaryotic cells (from plants, algae, animals) are not all the same: they are divided into animal and plant.
2 - Microscopes are instruments that allow us to visualise cells.
3 - We can see plant and animal cells under the microscope.

› Keywords:
1 - different cells
2 - microscope
3 - animal and plant cells

Structure

› Start:
How to start? With a brief introduction about myself

>> Presentation about me: show some pictures of me as a child at school and with the teacher. Tell very briefly why I study science and my journey.
To introduce, I will ask if they know what a cell is and what a cell and a Lego have in common.

› Activities:
1- Allow manipulation and labeling of the various organelles of the two cell types and understand the biggest differences (10 minutes)
2- Microscope observation and labeling of the different components (5 minutes)
3- Sample preparation, drawing what they see under the microscope (35 minutes)

› End:
How to finish? With a final question

>> At the end, after we do the experiments and tidy up the material, I will ask again "And now, can you tell me what a cell and a Lego have in common?"

Workshop Formats

› Number of workshops: 2
› Duration: 90

› Formats:
individual activities, group activities/discussion, experimentation/practical activity

Materials and Resources

› Materials to be used:
2 - microscopes
3 - microscopes, swabs, glass slides, coverslips, 70% alcohol, paper towel, methylene blue, spray bottle with water, tweezers, microscopy image with this information, definitive preparations of plant material - show these if it doesn't work for them to see anything (if it doesn't work), infusion (take and see various animals)

› Materials to acquire:
I will invite a college colleague to accompany me

Figure 4. Workshop Preparation Board.

This tool was used to plan the structure, content, activities, and materials for the hands-on workshop on cell biology.

The three topics were then identified: (1) the distinction between animal and plant cells, (2) the structure and purpose of a microscope, and (3) the possibility of observing cells using a microscope. For each topic, an activity was developed. To introduce the first topic, a short educational video was used to illustrate the differences between plant and animal cells. The second topic involved a hands-on demonstration in which children identified the components of a microscope and learned their functions. The final topic consisted of preparing and observing biological samples under the microscope. Figure 4 offers a visual summary of the workshop plan described above.

The practical preparation phase required testing potential samples to ensure their suitability for use with children. Professor Fernando Tavares provided his laboratory and materials, allowing to test different biological specimens and refine protocols. Additionally, the Department of Biology lent two optical microscopes, ensuring that all children would have the opportunity to engage directly with the equipment.

One month before the workshop, the timetable was finalised and shared with both teachers and the municipality. Furthermore, teachers received the pre- and post-workshop sheets to be implemented, along with the consent forms for legal guardians to fill. Two weeks before the workshop, the final logistical details were aligned with the school, such as the place for lunch, confirmation of signed consent forms, and some guidelines for the day.

On the day of the workshop, both the President of Póvoa de Varzim and the school's head teacher were present. I was supported by a colleague of mine, also a Cell and Molecular Biology student. The session began with a brief introduction in which I explained that I had once been a student at that same school as well. A donation of books was made to the school library as part of the opening moment. The workshop then proceeded with an initial question: how cells and Legos relate. This was followed by the activities planned. The first challenge invited children to draw a cell on the whiteboard and to discuss their drawings. After watching the introductory video, children participated in a matching game to associate organelles with either plant or animal cells. The microscope was then introduced, and each component was explained in relation to its function.

The last activity involved sample preparation and microscope observation. Children were divided into four groups, each responsible for preparing one biological sample: onion epidermis, water sample from a lake, *Elodea* leaves, and human cheek cells. Each group received a protocol adapted for their age.

The onion group had to remove a thin epidermal layer using a scalpel, under my supervision. Then they placed it on a glass slide with a drop of water, staining it with methylene blue. After waiting five minutes, they removed the excess and added a coverslip. The cheek cell group used a toothpick to carefully scrape the inside of their mouths. After that, they would mix the sample with a drop on a glass slide and stain it with methylene blue. They would then place a coverslip after waiting five minutes and removing the excess. The *Elodea* group carefully cut a leaf and placed it in a drop of water on the glass slide, followed by a coverslip. The lake-water group placed a drop of lake water containing sediment on the slide and placed a coverslip.

Once all the preparations were ready, each child had the opportunity to observe all four samples under the microscope. They were encouraged to draw what they were observing, using a visual aid displayed on the whiteboard, which had been prepared during the laboratory trials. In the closing discussion, the initial metaphor connecting cells and Legos was revisited, and children had the opportunity to explain it with their own words.

To conclude the session, children completed the feedback sheets, certificates of participation were distributed, and a group photo was taken. Then the workshop was repeated with the other 4th-grade class from that school.

After the workshop, a thank-you email was sent to both the municipality and teachers, acknowledging their collaboration and support. Teachers also received the post-workshop sheets, which they were asked to complete with their students. Photographs taken during the workshop were collected and shared with the teachers, ensuring that all stakeholders had access to the visual documentation of the activities. Once the completed post-workshop sheets were returned, they were archived together with the consent forms and pre-workshop sheets. This ensured that all materials required for the programme's monitoring and evaluation framework were consolidated and stored appropriately.

2.4. Planning and Coordination of "Para Além do Laboratório"

In collaboration with the Faculty of Science of University of Porto (FCUP) and Native Scientists, the event "Para Além do Laboratório" was organised. This initiative aimed to promote dialogue between scientists, stakeholders involved in Science Communication, and mainly university students, highlighting diverse scientific careers in STEM (Science, Technology, Engineering and Mathematics) areas, outside of the laboratory and with particular emphasis on professional pathways within science communication.

The first step in organising the event was to contact FCUP Library to verify the availability of the auditorium on the intended date, 15th of April. Once both availability and authorisation were secured, the reservation was formalised, allowing the remaining components of the event to be scheduled.

The next stage involved identifying and inviting potential speakers whose scientific backgrounds and careers aligned with the event's objectives. To do this, Fernando Tavares and Joana Moscoso, my supervisors, provided an insightful view. The selection was guided by several considerations: assembling a panel with diverse perspectives, ensuring that speakers were somehow involved with Science Communication, and were available on the selected date. Invitations were sent individually, explaining the purpose of the event, expected format, and logistical details. Confirmations were then tracked.

The dissemination of the event to the public was carried out through multiple communication sources. Communication materials were created, including a poster and an introductory text, both emphasising the event's purpose and encouraging participation from students and other members of the academic community. The event was promoted through the Biology Department's newsletter, FCUP's social media, and Native Scientists' platforms. It was also shared with teachers, students' groups, and other relevant contacts to broaden participation. A registration link was created to monitor expected attendance and to support logistical planning, such as seating arrangements.

Throughout the preparation process, close coordination with FCUP was essential to ensure the feasibility of the event. This included aligning with institutional procedures, requiring technical aid regarding microphones and visual support, and coordinating with the library team.

At the beginning of the session, participants responded to four statements using a colour-card system, where green means they agree with the sentence, and orange means they disagree. The statements were: (1) I have questioned my career path and wondered whether I was making the right choice, (2) I would like to learn more about science communication, (3) I think that during my academic training I should have received some grounding in science communication, and (4) I feel that my scientific institution or faculty provides opportunities to engage in outreach.

Following this activity, the panel discussion was guided around four thematic areas: (1) personal experiences and motivations related to transitioning into or engaging with science communication; (2) the role of science communication within academic training and scientific careers; (3) institutional perspectives on the visibility, value, and support

for science communication within faculties and research centres; and (4) opportunities for students and early-career scientists to participate in outreach activities.

The session concluded with a Q&A period, allowing participants to raise additional questions and engage directly with the panel.

Chapter 3: Results

3.1. Training helped scientists feel better prepared for their workshops

The online training sessions took place between September and May, beginning on the 16th of September and concluding on the 19th of May.

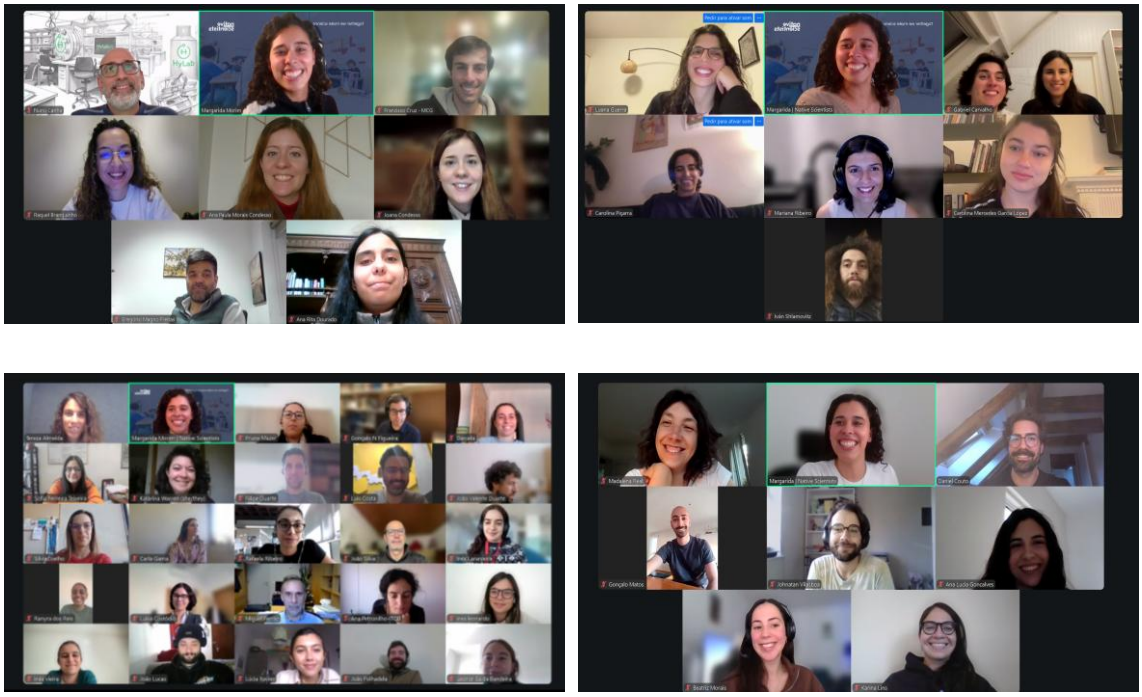


Figure 5. Screenshots captured during the training sessions.

On the left, screenshots refer to SHT sessions and, on the right, SMC training sessions.

In total, 25 sessions were delivered, ten for the Same Migrant Community programme, fifteen for the Same Home Town. These sessions were attended by a total of 185 scientists. Of these, 39 attended the Mentor Induction (SMC training), and were based in six different countries (United Kingdom, Switzerland, France, Spain, the Netherlands and Germany), representing three different mother tongues (Portuguese, Spanish and Italian). Within the SHT programme, 146 scientists attended the training sessions. Figure 5 presents screenshots from these sessions.

Immediately after attending the training sessions, participants were invited to fill in a feedback form created to measure their satisfaction in relation to the training, their self-perception of knowledge acquisition, and their feelings regarding the programme. The response rate was 27% (50 participants out of the 185 filled in the feedback form).

Results show that most participants (97.76%) rated the training experience as “4 - Very Good” or "5 - Excellent", resulting in an overall score of 4.9 in 5, Figure 6A. When asked “Did you learn something new?”, on a scale of 1 (“Nothing”) to 5 (“A lot”), 56% answered “4,” and 28% answered “5”, followed by 16% who responded “3”, Figure 6B. Regarding the statement “The training session helped me to know what to expect on the day of the workshop”, on a scale of 1 (“Strongly Disagree”) to 5 (“Strongly Agree"), 68% responded “5” and 24% answered “4”, while 6% responded “3” and the answer for 2% was “2”, Figure 6C.

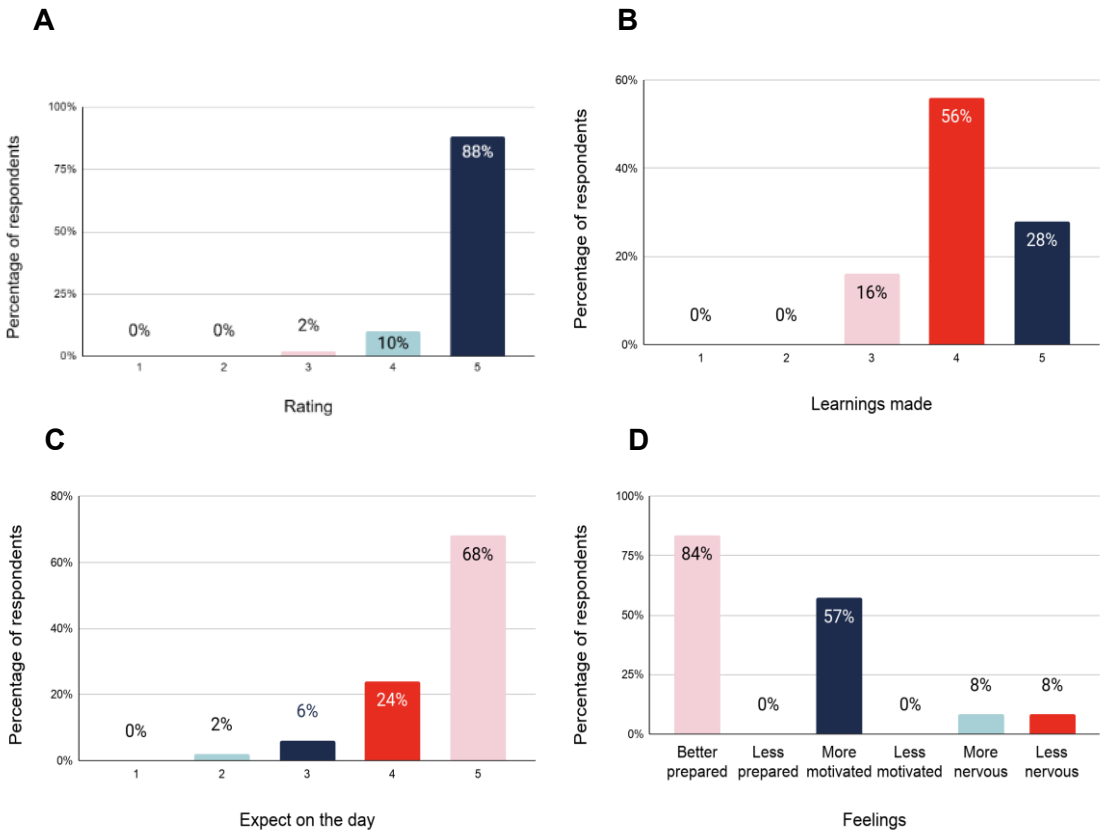


Figure 6. Summary of participants' feedback on the training session.

(A) Participants’ overall rating of the session (1 = Very poor; 5 = Excellent). (B) Response to the question “Did you learn something new?” rated on a 1 (Nothing) - 5 (A lot) scale. (C) Agreement with the statement “The training session helped me to know what to expect on the day of the workshop.” also rated on a 1 (Strongly Disagree) - 5 (Strongly Agree) scale. (D) Reported feelings after the training session, presented as the percentage of respondents selecting each option.

Additionally, participants reported feeling better prepared (84%), more motivated (57%), and less nervous (8%) for their workshop, as displayed in Figure 6D. No participant reported feeling less prepared or less motivated, and 4% indicated feeling more nervous after the session.

Lastly, key takeaways from the session included the importance of keeping the workshop dynamic and flexible, learning effective strategies for interacting with children, and understanding how to simplify scientists' work. As one scientist summarised, “In this webinar, I learned that communicating science to children means translating complex concepts into experiences that make sense in their world, allowing them to feel, see, or experiment with those ideas so they can truly assimilate them.”

In addition to the quantitative data, the feedback form also allowed for the collection of qualitative data on how to improve the training. A total of 9 participants made suggestions and a manual analysis of the answers revealed two key themes emerging: (a) scientists suggested making the session more practical and adapted to different scientific areas, with real examples of how to design age-appropriate workshops, translating complex topics into accessible activities; and (b) participants also expressed interest in focusing more on personal motivations to be participating in the programme, and highlighted the value of understanding what children have already learned in science to better prepare their sessions. In addition, they recommended offering more concrete examples for scientists participating for the first time and keeping the session slightly shorter without losing its usefulness.

3.2. Scientific diversity in the workshops and experience of children, teachers and scientists

3.2.1. All six areas of knowledge covered in the workshops

In the school year of 2025/2026, I implemented a total of 21 workshops. These covered a broad range of scientific areas, based on the OECD classification (OECD, 2007).

In terms of distribution, one workshop focused on Agricultural and Veterinary Sciences, ten on Natural Sciences, four on Medical and Health Sciences, four on Engineering and Technology, and one each on Social Sciences and Humanities and the Arts. The distribution is shown in Figure 7 and reflects the multidisciplinary nature of the programme and the varied expertise of the participating scientists.

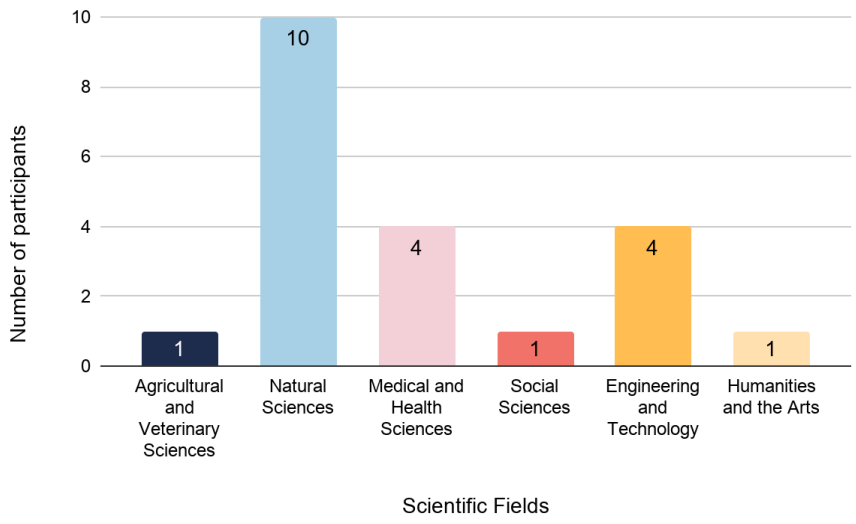


Figure 7. Areas of science covered in the workshops.

These included Agricultural and Veterinary Sciences, Natural Sciences, Medical and Health Sciences, Social Sciences, Engineering and Technology, and Humanities and the Arts.

Table 1 summarises all workshops, indicating the municipalities where the workshops happened, the science field and scientific topics, and the TEIP schools that received the programme. For privacy reasons, neither the names of scientists nor workshop dates are presented.

Table 1. Summary of the twenty-one workshops delivered in the 2025/2026 school year.

It is organised by municipality and its priority (left column), workshop theme (central column), and participating schools (right column). The abbreviation “EB” stands for Escola Básica.

Municipality – Priority Community	**Science Field - Scientific Topic**	**Schools**
Cinfães - Priority	Natural Sciences - Our immune system is like a fortress that protects our body	EB Nespereira EB São Cristóvão
Felgueiras - Priority	Engineering and Technology - Understanding air pollution and what can we do to stop it	EB Outeiro EB Boavista
Felgueiras - Priority	Medical and Health Sciences - What “bad cells” do to our bodies	EB n.º 1 de Felgueiras

Fundão - Super-Priority	Natural Sciences - Nature can recover when we give it space and time, and this brings benefits for biodiversity and for people	EB João Franco EB Silvares
Gondomar - Priority	Natural Sciences - We are all made out of cells	EB Passal EB Carvalhal e Mó
Gondomar - Priority	Natural Sciences - DNA is like an instruction manual	EB Alvarinha EB Montezelo
Gondomar - Priority	Engineering and Technology - What is Chemical Engineering and what does a scientist do	EB Vila Verde EB Silveirinhos
Gondomar - Priority	Medical and Health Sciences - There are different types of cells and we can see them using a microscope	EB Arroteia
Horta - Super-Priority	Natural Sciences - We can all be scientists if we want to	EB Flamengos EB Cedros
Lagoa (Algarve) - Priority	Natural Sciences - That anyone can be a scientists and the conception of macro and micro	EB Parchal EB Estômbar
Lisboa - Priority	Social Sciences - How humans evolved over times	Externato Educação Popular
Lisboa - Priority	Natural Sciences - Life may not be unique to Earth, and science is increasingly close to discovering whether it exists elsewhere in the universe	EB Arquitecto Gonçalo Ribeiro Telles
Machico - Super-Priority	Natural Sciences - Sharks are important to regulate the ecosystem	EB Eng. Luís Santos Costa
Mogadouro - Priority	Agricultural and Veterinary Sciences - How agricultural science supports sustainable food systems and local production	EB Mogadouro

Palmela - Priority	Natural Sciences - Studying Earth's diversity give us clues about where and how life can exist in other planets.	EB n.º 1 de Águas de Moura
Resende - Priority	Natural Sciences - Biodiversity is important to ensure species survival	EB n.º 1 de Resende
São João da Pesqueira - Priority	Medical and Health Sciences - Toxicology scientists use laboratory techniques to resolve crimes	EB São João da Pesqueira EB Paredes da Beira EB Trevões EB Ervadosa do Douro
Viana do Castelo - Priority	Medical and Health Sciences - Our brain is a very important organ and we should adopt healthy habits to protect it	EB Subportela EB Vila Nova de Anha
Viana do Castelo - Priority	Humanities and the Arts - The coastline is in constant transformation, and its history can be reconstructed through sources that reveal how nature and people have adapted over time	EB Chafé EB Cabedelo
Vila do Porto - Super-Priority	Engineering and Technology - We can teach machines to do things, just like we teach humans	EB Aeroporto EB São Pedro
Vila Verde - Priority	Engineering and Technology - Microorganisms are superheroes capable of helping to clean the planet while also producing renewable (and more environmentally friendly) energy	EB Cabanelas EB Oleiros EB n.º 2 de Vila Verde

As shown in Table 1, 21 scientists returned to their primary schools or hometowns, delivering workshops across fifteen municipalities. Following the selection method mentioned in **2.2.**, 11 municipalities were considered "priority" and 4 were considered "super-priority", which aligns with Native's mission to bring science to communities where access to such opportunities may be more limited.

3.2.2. Participant scientists demonstrated diversity in career and gender

Complementing the territorial distribution, the participating scientists reflected diversity in terms of gender, disciplinary background and career stage, as reflected in Figure 3.

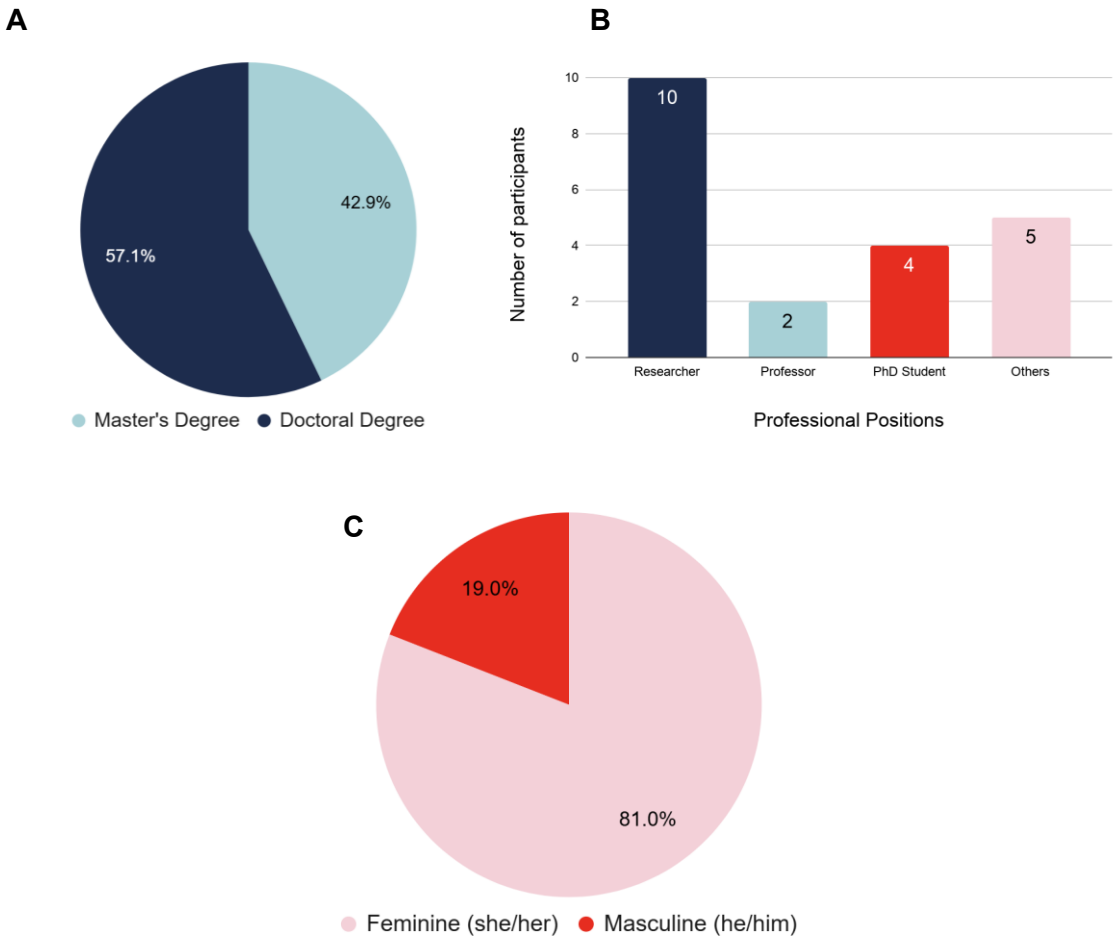


Figure 8. Set of three graphs illustrating programme participants' characteristics.

(A) a pie chart of highest educational level, (B) a bar graph of current professional positions, and (C) a pie chart showing the distribution of preferred pronouns.

Most scientists participating in the workshops held a Doctoral degree (57,1%), while 42,9% had a Master's degree as the highest level of education, Figure 8A. In terms of current professional position, approximately ten scientists were researchers, either Principal Investigators or Junior Researchers. There were also two Professors and four doctoral students, and five scientists working in diverse roles, such as Rewilding Officer, Technical Officer at the Regional Directorate of Fisheries, and European Projects Coordinator, Figure 8B. Lastly, regarding preferred pronouns, 81% used feminine pronouns, and 19% used masculine pronouns, as illustrated in Figure 8C.

The following images illustrate activities carried out during some of the workshops (Figure 9). They show children engaging with materials, scientists using visual examples and pictures to illustrate concepts, and moments where creativity was encouraged within scientific themes, highlighting the interactive and hands-on nature of the sessions.

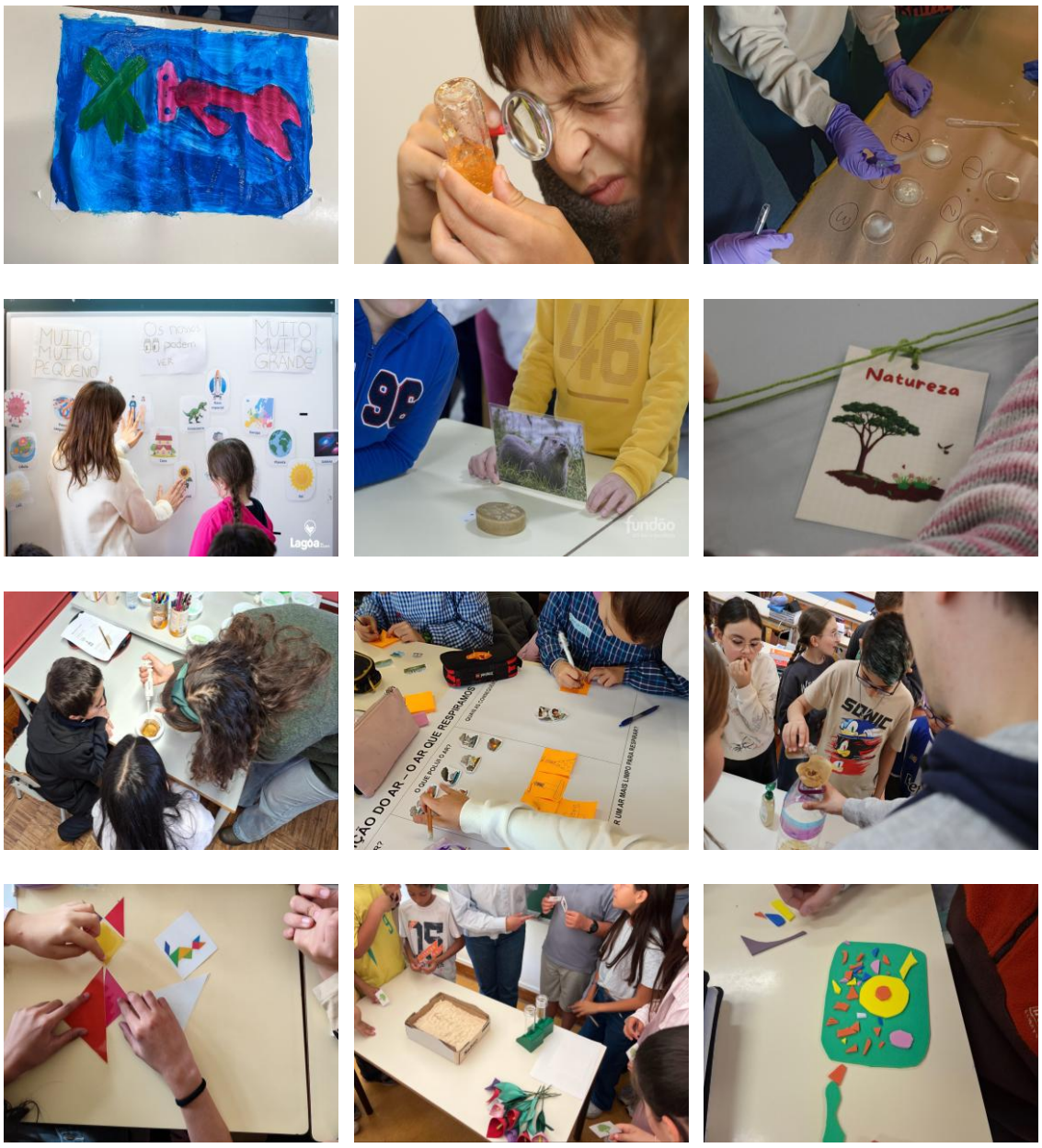


Figure 9. Photographs illustrating activities carried out during the workshops.

They show hands-on exploration of materials to the use of visual examples, and creative approaches used to engage students with scientific ideas.

3.2.3. Children like meeting scientists “very much” and they learned many new things

A total of 897 children interacted with scientists from their hometown. These workshops reached over 55 classes across 34 different schools, distributed over 15 Municipalities, as previously described. Notably, more than 60% of these children met scientists for the first time in their lives, Figure 10A. The overall workshop rating was positive: 98% of children reported that they liked meeting the scientists “very much”, with 2% answering “somewhat”, and 0% saying “Not at all”, Figure 10B. Regarding the workshop content, 78% stated they learned “many new things”, 23% learned some new things, and 1% learned nothing new, Figure 10C. “Spectacular” was the most frequent word choice to describe the workshops (70%), followed by "Interesting", (28%), with 1% answering “Nothing special” or “Boring”, Figure 10D.

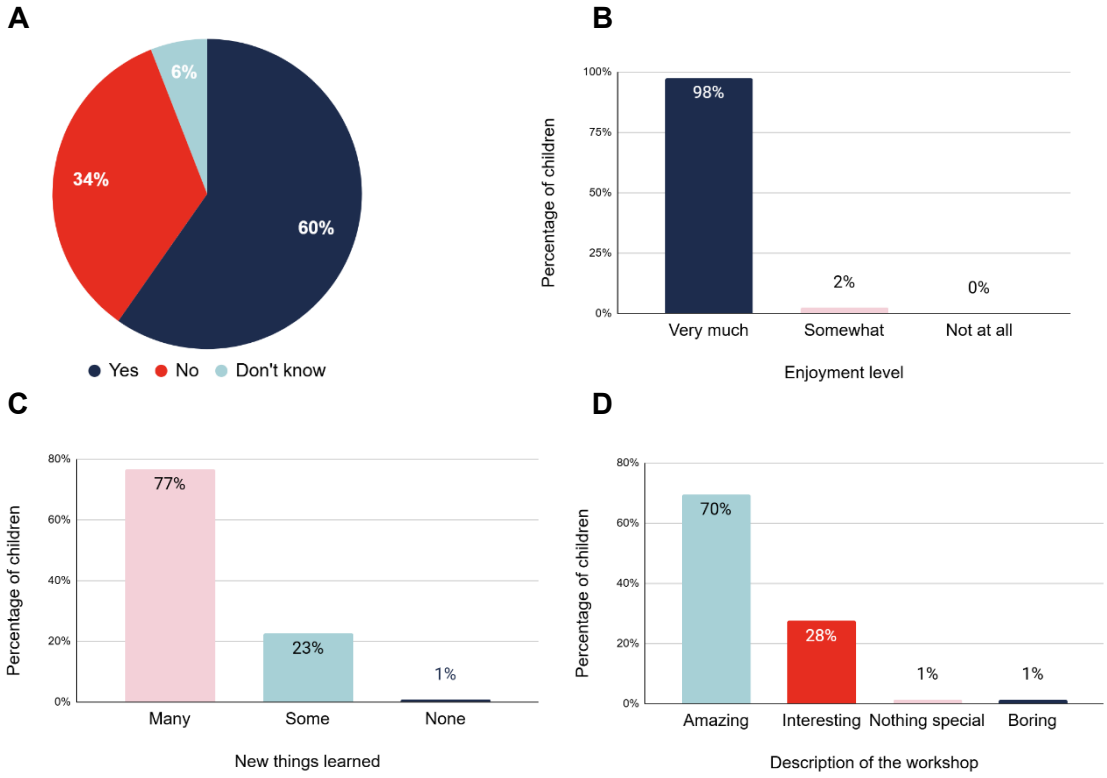


Figure 10. Children' s perspectives on the workshops.

(A) Responses to whether it was their first time meeting a scientist (Yes/No/Don’t know). (B) Percentage distribution of reported learning of new things (Many/Some/None). (C) Descriptions of the workshop using predefined categories (Amazing/Interesting/Nothing special/Boring). (D) Enjoyment level when meeting the scientist (Very much/Somewhat/Not at all).

Immediately after the day of the workshop, teachers received a feedback form collecting qualitative and quantitative data on their experience with the programme and on whether they recommend it. Overall, teachers provided very positive feedback. 98% rated the experience as “Very good” or "Excellent", and 1% rated it as a “3”, Figure 11A. Moreover, 84% stated they would recommend the programme to their colleagues, and 2% were

unsure, Figure 11B. They emphasised that the workshops were well planned and appropriate for their students. They highlighted the scientists' ability to explain complex topics dynamically and interactively, which created space for learning, both for the students and the teachers. Overall, the workshops were described as a success. One teacher even said "I acknowledge the privilege we had in learning so much in such a short time [...]. This was made possible by the excellent guidance of the scientist, who, playfully and engagingly, enabled students to grasp such relevant knowledge."

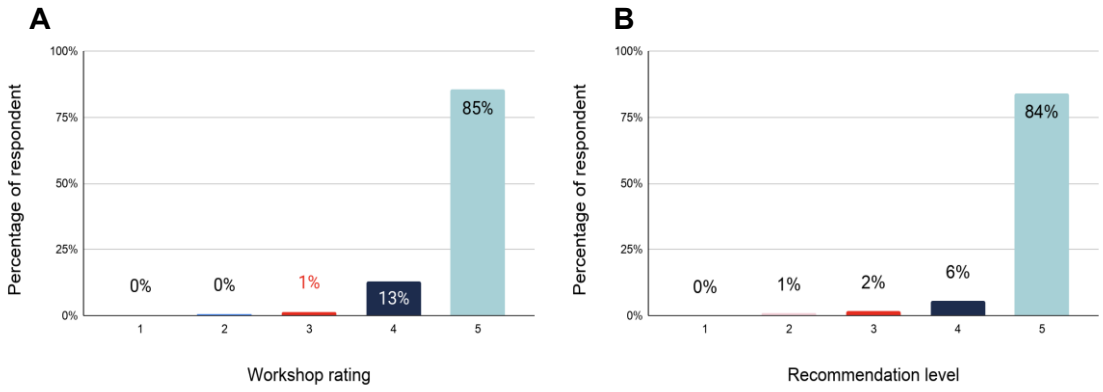


Figure 11. Teachers' perspectives on the workshop.

(A) Percentage distribution of responses for overall experience rating on a five-point scale, where "1" corresponds to "Very bad" and "5" to "Excellent". (B) Percentage distribution for the recommendation level on a five-point scale, where "1" corresponds to "Not at all" and "5" to "Yes, definitely".

Suggestions for improvement included extending the duration of the workshop and offering the programme as a continuous rather than a one-time-only experience.

Feedback from scientists also revealed a strong positive impact. According to registration data, 25% of scientists "never" or "almost never" engage in outreach activities. Even so, in the feedback form sent the day after the workshop, 99% rated the experience as "Very good" or "Excellent", with 1% of participant scientists rating it as a "3", as shown in Figure 12A. 99% recommended the experience, while 1% was unsure, Figure 12B. They described the workshops as rewarding and energising, frequently noting the children's strong interest, active participation and enthusiasm during the activities. Some highlighted that, for many children, it was the first time meeting a scientist, which generated excitement, and invitations to return to the school more times.

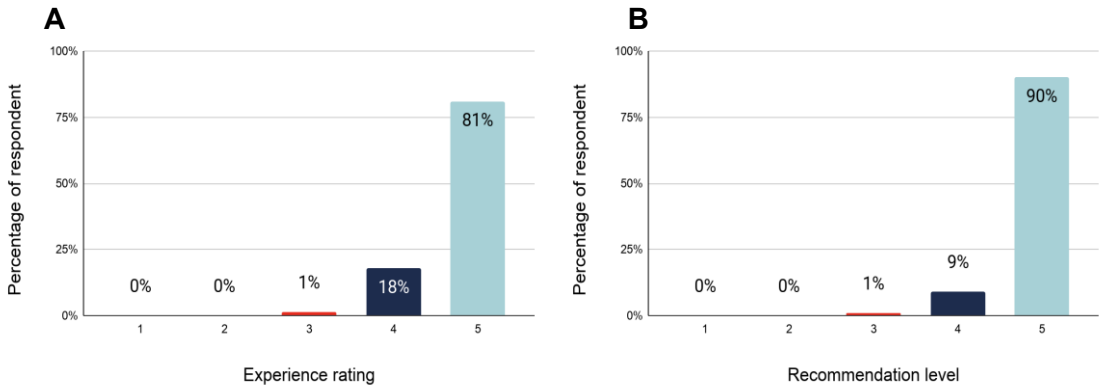


Figure 12. Scientists' perspectives on the workshop.

(A) Percentage distribution of responses for overall experience rating on a five-point scale, where "1" corresponds to "Very bad" and "5" to "Excellent". (B) Percentage distribution for the recommendation level on a five-point scale, where "1" corresponds to "Not at all" and "5" to "Yes, definitely".

Scientists expressed gratitude for the opportunity and felt motivated to participate in the future. For those returning to their own primary school, the experience was described as both nostalgic and deeply rewarding and sharing their scientific journeys and careers with the children felt truly meaningful. One scientist even said, "This contact with these children reestablished my faith in humanity". However, some challenges were also reported. Some scientists felt discontent with teachers' lack of involvement, delays in the delivery of the KIT, technical issues, and variability in class engagement. The overall feedback was very positive and encouraging.

At a national level, the Same Home Town programme reached 6423 children during the school year of 2025/2026. A total of 141 scientists returned to their primary schools or hometowns, delivering workshops to 337 classes across 205 schools. Of the 78 municipalities that received the programme, in 15 of them all children from Year 4 in public school were reached, as shown in Figure 13.

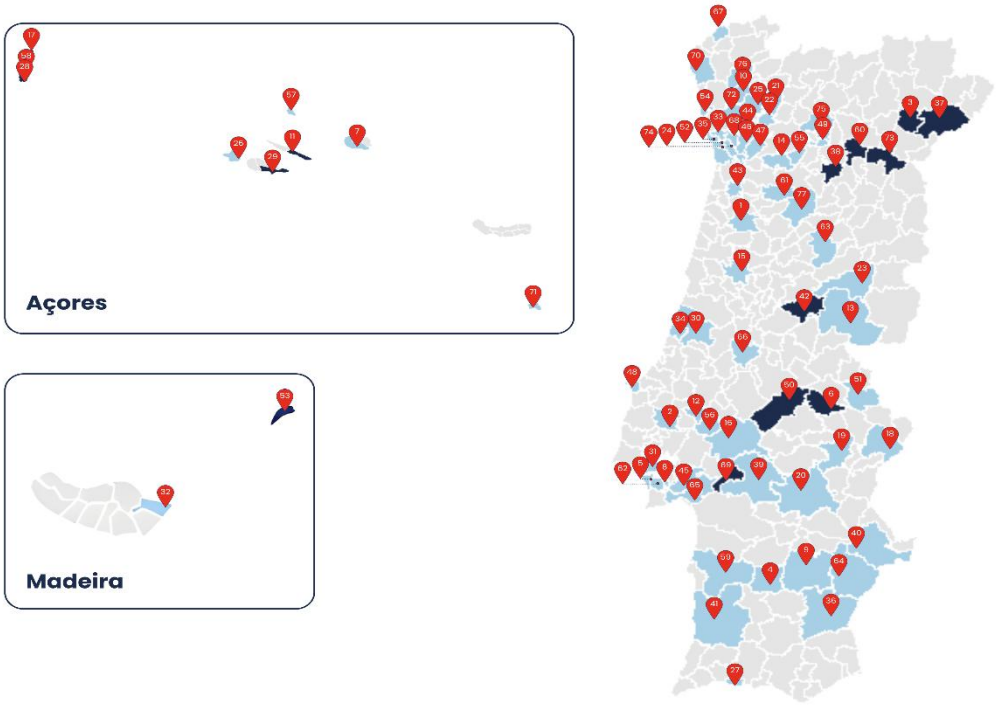


Figure 13. Municipalities that received the SHT programme in 2025/2025.

Municipalities shaded in light blue represent those where the programme reached part of Year 4 students in public schools, whereas dark blue highlights municipalities where all students from Year 4 were reached. 1 – Águeda, 2 – Alenquer, 3 – Alfândega da Fé, 4 – Aljustrel, 5 – Almada, 6 – Alter do Chão, 7 – Angra do Heroísmo, 8 – Barreiro, 9 – Beja, 10 – Braga, 11 – Calheta, 12 – Cartaxo, 13 – Castelo Branco, 14 – Cinfães, 15 – Coimbra, 16 – Coruche, 17 – Corvo, 18 – Elvas, 19 – Estremoz, 20 – Évora, 21 – Fafe, 22 – Felgueiras, 23 – Fundão, 24 – Gondomar, 25 – Guimarães, 26 – Horta, 27 – Lagoa, 28 – Lajes das Flores, 29 – Lajes do Pico, 30 – Leiria, 31 – Lisboa, 32 – Machico, 33 – Maia, 34 – Marinha Grande, 35 – Matosinhos, 36 – Mértola, 37 – Mogadouro, 38 – Moimenta da Beira, 39 – Montemor-o-Novo, 40 – Moura, 41 – Odemira, 42 – Oleiros, 43 – Oliveira de Azeméis, 44 – Paços de Ferreira, 45 – Palmela, 46 – Paredes, 47 – Penafiel, 48 – Peniche, 49 – Peso da Régua, 50 – Ponte de Sor, 51 – Portalegre, 52 – Porto, 53 – Porto Santo, 54 – Póvoa de Varzim, 55 – Resende, 56 – Salvaterra de Magos, 57 – Santa Cruz da Graciosa, 58 – Santa Cruz das Flores, 59 – Santiago do Cacém, 60 – São João da Pesqueira, 61 – São Pedro do Sul, 62 – Seia, 63 – Seixal, 64 – Serpa, 65 – Setúbal, 66 – Tomar, 67 – Valença, 68 – Valongo, 69 – Vendas Novas, 70 – Viana do Castelo, 71 – Vila do Porto, 72 – Vila Nova de Famalicão, 73 – Vila Nova de Foz Côa, 74 – Vila Nova de Gaia, 75 – Vila Real, 76 – Vila Verde, 77 – Viseu.

3.3. Learning about cells is “Spectacular”

The workshop in my primary school took place on 10th of December, in Póvoa de Varzim. It was attended by 39 children, 17 from one class and 22 from another.

Engagement throughout the workshop was good. Children felt comfortable asking questions, even those beyond the workshop topic, and showed genuine curiosity about cells and the scientific concepts introduced. Children were also able to complete all the proposed activities. They correctly matched each organelle to the corresponding type of cell and showed enthusiasm and curiosity when working with the microscope. They were able to prepare all samples, observe them under the microscope, and produce drawings that closely reflect what they were seeing, as shown in Figure 14.



Figure 14. Pictures from my workshop.

On the upper left, a child is drawing a cell; on the upper right, a child is asking a question; on the lower left, children are preparing the samples with the help of the teacher, and on the lower right, a child is showing their drawings.

Feedback collected on the day further illustrates this positive reception. 64% of the children reported that it was their first time meeting a scientist, 31% indicated it was not their first time, and 5% were unsure, as shown in Figure 15A. Regarding learning outcomes, 86% shared that they learned “a lot of new things”, 13% reported learning “some new things”, and 0% said they learned nothing new, Figure 15B. Most children described the workshop as “Spectacular” or “Interesting” (95%), while 5% considered it “Nothing Special”, and none described it as “Boring”, Figure 15C. In addition, 97% of the children shared that they really liked meeting the scientist, whereas 3% liked it “more or less”, Figure 15D. When asked why they enjoyed the workshop, some children explained that it was because they “learned new things that [they] didn’t know before”, adding that they discovered how to use the microscope and had learned about cells.

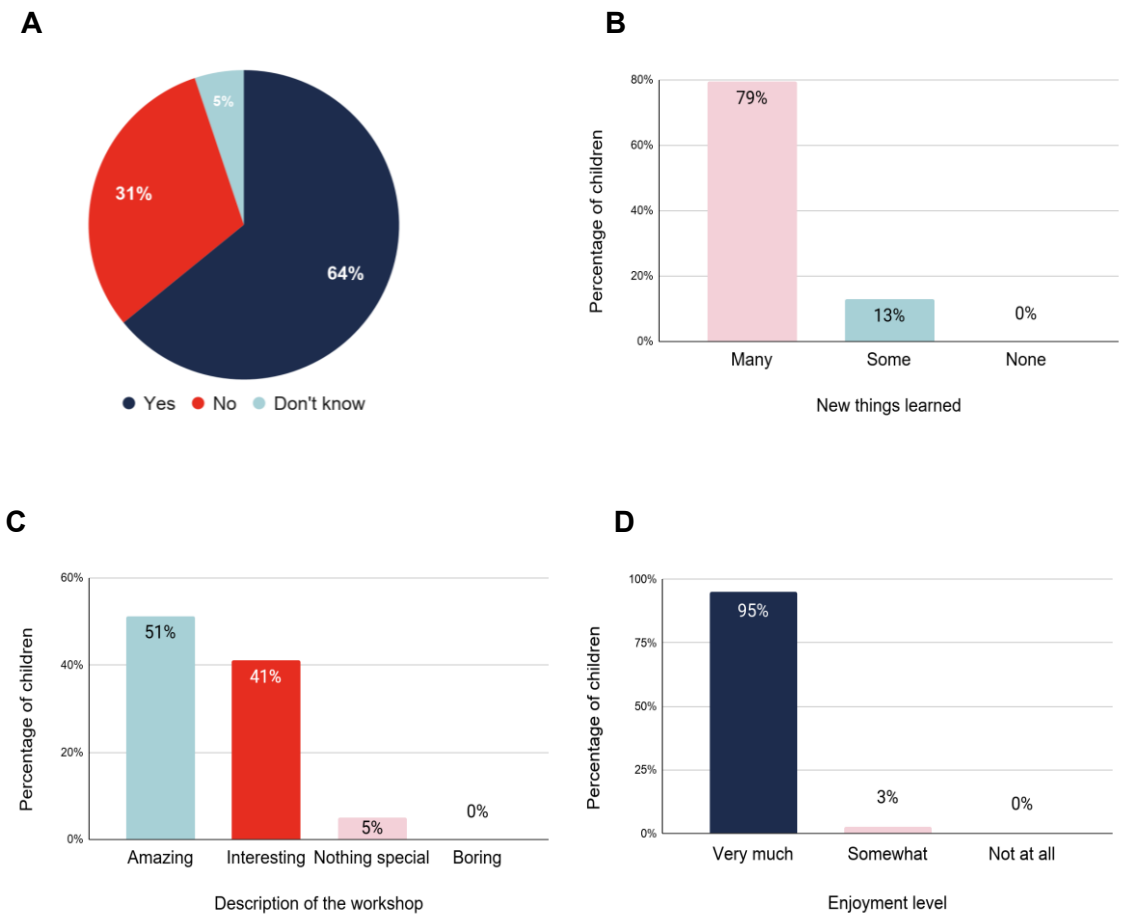


Figure 15. Children' s perspectives on my workshop.

(A) Responses to whether it was their first time meeting a scientist (Yes/No/Don't know). (B) Percentage distribution of reported learning of new things (Many/Some/None). (C) Descriptions of the workshop using predefined categories (Amazing/Interesting/Nothing special/Boring). (D) Enjoyment level when meeting the scientist (Very much/Somewhat/Not at all).

Teachers also emphasised the value of initiatives like this. One teacher noted that seeing a scientist who had once been a student at their school helped children realise that they too can pursue scientific careers, reinforcing the importance of relatable role models. She even added that programmes like this one are always meaningful for children, there is always something that stays in their minds. “We cannot impact all seventeen students, but we can impact one, and that is how it goes. It is from when they are little that they become great people.” The second teacher shared that the workshop conveyed a strong sense of possibility and future: the scientist represented what the children could become, having studied in the same place and followed a good path. She concluded by saying, “We would like her to be here more times!”

Lastly, the initiative received recognition from the President of Póvoa de Varzim, who attended the session, as shown in Figure 16, and highlighted the importance of strengthening the community's connection to science, encouraging younger generations to invest in a future in scientific research.

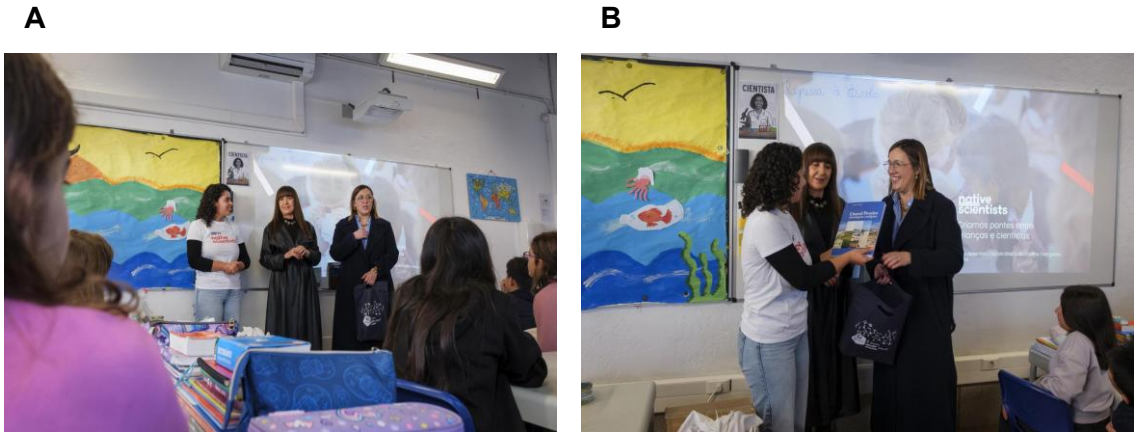


Figure 16. Photographs from the workshop.

(A) Shows the President of Póvoa de Varzim (right) and the head teacher of Amorim, Terroso and Beiriz school cluster (middle). (B) Shows the President offering a book about the coastline of the city.

3.4. Beyond training in science communication, the need for opportunities to put it into practice

"Para Além do Laboratório" happened on 15th April, in FCUP's auditorium and brought together 20 participants whose backgrounds spanned several fields and institutions, including Native Scientists, Psychology, the Institute of Public Health of the University of Porto, Science Communication, Biology, University of Minho, and the Master's in Science Education and Communication.

The panel was composed of four speakers. Áurea Ramos, Head of Image and Communication at FCUP; Joana Moscoso, co-founder and director of Native Scientists; Júlio Borlido, Communication Unit Coordinator at the Institute for Research and Innovation in Health (i3S); and Professor Paulo Carvalho, professor in FCUP's Master's in Science Education and Communication. I served as the moderator of the session, Figure 17A.

Before introducing the panel, participants were invited to reflect on their own experiences, using two coloured cards, one green if they agree with the sentences and

one orange if they disagree, as shown in Figure 17B. Participants' responses revealed clear patterns across the four statements. Agreement was nearly unanimous for the first three items, which addressed career uncertainty, interest in science communication, and the perceived need for communication training during academic formation. Responses to the final statement, concerning the availability of outreach opportunities within their institutions, were more heterogeneous.



Figure 17. Photographs from the beginning of the event.

(A) A photograph of the panel and the auditorium with the participants. (B) A photograph that captures the moment of using the green and orange cards to answer the statements.

The round table discussion began with Joana Moscoso, who shared her journey as a scientist who discovered a passion for science communication and for making science accessible for everyone, Figure 18A. She recalled learning about bacteria at the age of nine and being fascinated, despite people around her thinking she was "crazy". Years later, once she became a scientist, like she dreamt, she felt compelled to speak with children about her work so they would not feel the barriers she once felt. One of her biggest challenges, she explained, was, as creating a non-profit organisation, the fear that other scientists would view her as "less of a scientist" for dedicating time to communication. Over time, she overcame this perception. Regarding her training, she noted that despite having attended a science communication training, she had to work autonomously, by reading extensively and learning by observing others.

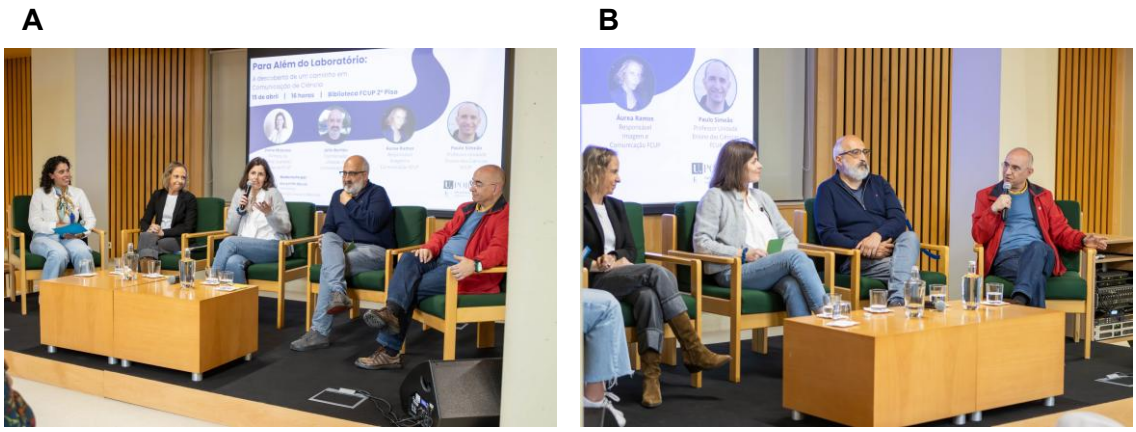


Figure 18. Photographs from the event.

(A) A photograph from the panel and Joana Moscoso speaking. (B) A photograph of Professor Paulo engaging with the panel.

Professor Paulo Carvalho then addressed whether science communication should be integrated early in academic training. He explained that he had no exposure to science communication during his studies and was the first in the course to do something like a "science show". Because he had no preparation for communicating with the public, carrying out that activity required learning on his own. He emphasised that having had formal training beforehand would have been extremely helpful. He added that, although Physics courses teach students how to communicate scientific content, this training is oriented towards scientific contexts rather than public engagement, Figure 18B.

The discussion then moved on to Áurea Ramos, Figure 19A, who emphasised the mutual benefits of science communication in her work: it brings university closer to the students and helps researchers connect with broader audiences. She described her work as a communicator between scientists and their target audiences. She also added that researchers often present excellent projects that are difficult for non-specialist audiences to understand, partly due to the lack of professional science journalists. She highlighted her strategy of "decoding scientific jargon", stating that even outstanding projects fail if they cannot reach their intended audiences. For her, early exposure to science is essential for children, and the main challenge lies in ensuring that messages are both accurate and understandable.

Júlio Borlido, Figure 19B, followed by discussing the different forms of science communication, and how the field has evolved. He emphasised that communication is not a single practice but a spectrum of approaches that must adapt to context, audience, and institutional goals.

A B



Figure 19. Photographs from the event.

(A) Captures Áurea Ramos addressing the question made by the moderator. (B) Shows Júlio Borlido participating in the discussion.

A period of questions from the audience then opened the floor, Figure 20. Participants asked how scientific work can be translated for the public and how to approach scientists, who are really involved in their work, because their research is not that easy to communicate. The discussions highlighted the need to treat communication as a core scientific skill, and to create institutional spaces where communication is valued and practised.

The panel then responded. Joana added that communication is a transferable skill essential in many contexts, not only in outreach. Professor Paulo Carvalho added that, beyond teaching communication, institutions must provide opportunities for students to practise it, something he feels is still lacking at FCUP. He gave the example of “Dia Aberto”, where each faculty had the opportunity to share their courses. He raised the question if any of those students had ever received training in science communication. Áurea highlighted the importance of mobilising researchers, noting that many do not recognise their need for support in science communication or even media training.

Joana then raised a broader issue: the educational system often places students into rigid “boxes”, which might limit their interest in or access to science.

The public continued with sharing experiences with science communication, such as “Universidade Júnior” and “Dias Abertos”. They highlighted the role of high school teachers who also bring together children and science and also raised awareness of the lack of communication training for university teachers.



Figure 20. Moments from the discussion.

(A) An audience member is asking a question. (B) The moderator is contributing to the discussion.

The audience then reflected on the pressure of having to choose a single academic path, even when students have diverse interests, reinforcing the idea of living and fitting into boxes. Participants noted that the traditional scientific career (Bachelor's, Master's, PhD, Postdoc) rarely includes science communication as a possibility for a career, reinforcing the motivations behind the creation of this event. Joana was asked about her biggest challenge when changing careers. She explained that the social impact of her work motivated her to pursue excellence in science. But it took her four years to accept that it was legitimate to build a career around what had once been her "hobby".

When asked whether social media could be a tool for science communication, Joana replied that there are "as many ways to communicate science as there are to cook codfish". Identifying our target audience is essential for defining strategy. Áurea added that scientists should not compromise their values to promote science but should find a balance that respects both the message and their own comfort. The message must always consider both content and audience. Julio emphasised that scientific institutions must safeguard credibility and then decide how they wish to engage with the public.

Professor Paulo revisited the idea that communicating requires simplicity. He shared an example from a physics fair where a student explained the magnetic variation in an overly complex way and concluded "if you don't understand, I can't explain". This, he argued, reinforces the idea that science is something only geniuses can understand. If we cannot explain it simply, it appears inaccessible. Joana then returned to the idea of communicating to reduce inequalities and demystify stereotypes, highlighting that we

must take science to those who may not otherwise encounter it, and not wait for them to come to us.

The audience also raised concerns about student engagement. They shared that sometimes activities are offered to them, yet no one attends. This prompted a discussion about whether activities genuinely respond to students' needs or whether they are created based on assumptions that do not match reality.

The session concluded by highlighting several key themes, namely the consensus on the importance of science communication and the need for training and opportunities. It was also noted the limitations of an educational system that places students into rigid categories, and the importance of designing science communication initiatives that genuinely meet the needs and interests of their audiences.

Feedback received via email from the event was very positive, from both the panel and the audience. Members of the panel expressed their appreciation for the invitation and highlighted the quality of the discussion, describing the roundtable as "a truly enjoyable experience". One speaker noted that two students who were in the audience shared how valuable it was to hear diverse perspectives on science communication, brought by each participant. The audience shared this sentiment, emphasising their gratitude for "an afternoon of extremely interesting discussion", and noting that the session had been enriching not only individually but also collectively. Furthermore, one of the main objectives of the event was to create a dynamic interaction between the audience and the panel, and the feedback received, together with the level of audience participation, suggests that this goal was achieved. While I led the first round of questions, which lasted approximately 40 minutes, the rest of the discussion was driven by the audience, with participants engaging directly with the panel for the remaining hour. This fluid exchange of ideas reflected both the audience's interest in the topic and the effectiveness of the roundtable format in promoting dynamism and involvement.

Chapter 4: Discussion

As scientific literacy becomes increasingly recognised as a foundation for a more equitable society (Sharon and Baram-Tsabari, 2020), the Programme for International Student Assessment (PISA), which monitors educational performance across European countries, also frames science as a basic skill, on par with reading and mathematics (OECD, 2023). However, Portugal continues to display a comparatively low level of scientific literacy, highlighting the need to strengthen science literacy across the population (IAVE, 2023; OECD, 2024). One way to achieve this is through science communication, engaging society in a meaningful interaction with scientists. However, scientists frequently report that the limited time, insufficient institutional support, and lack of opportunities to engage with the public diminish their ability to contribute to this effort, despite studies showing that science communication also brings benefits to researchers themselves (Calice et al., 2022; Riley et al., 2022; Bento et al., 2023). For children, early exposure to science is known to support their cognitive development, curiosity, and positive self-perception regarding scientific ability (Carballido et al., 2024; O'Connor et al., 2021). Yet significant barriers persist, including socioeconomic disparities, geographical isolation, and unequal access to scientific experiences.

This report presents the ROOTS project and the work I carried out as Programme and Training Manager at Native Scientists. This organisation seeks to address inequalities through educational programmes that broaden access to science and foster meaningful interaction between children and researchers. This project had four main goals: (1) delivering trainings in science communication, (2) implementing 21 workshops from The Same Home Town programme, (3) implementing one workshop in my primary school, and lastly (4) organising one event connecting FCUP and Native Scientists.

After analysing the results presented in the previous chapter, it is possible to discuss the relevance of the work carried out for both scientists and children.

For scientists, the participation in the Same Home Town programme was highly positive. First, the training session in science communication received very positive feedback, with several scientists noting that they felt more prepared and less nervous before their workshops. In line with the lack of time and limited opportunities described in the literature as barriers to scientists' engagement (Calice et al., 2022; Riley et al., 2022), this training acted as an accessible opportunity for researchers to gain insights into science communication topics. As mentioned before, in a context where 25% of scientists registered in our database report "never" or "almost never" participating in

science outreach projects, providing structural preparation becomes essential. Through these training sessions, scientists were not only supported in preparing for their workshops but were also equipped with transferable skills that can be applied across different professional contexts throughout their careers.

Evidence from the workshops further shows that scientists actively applied the strategies introduced during the training. As illustrated in Figure 9, where it is possible to see photographs from the workshops, scientists provided lab materials to children so they could interact with it, they used visual examples to explain certain concepts, as well as metaphors and analogies. Scientists also inspired children to be creative, using scientific topics as a muse for art. These practises reflect core principles of hands-on science teaching, and were recognised by the teachers, who praised scientists' ability to explain scientific concepts in an age-appropriate and engaging way.

Post-workshop feedback from scientists aligns with the literature on motivation and self-gratification in science communication (Bento et al., 2023). Feelings of professional and personal fulfilment, increased motivation for their work, and a desire to participate again reinforce Hunter's (2016) argument that scientists value sharing their research topics and often believe that science communication should be integrated in academic training. This idea was also evident during the event, where all the participants raised a green card in agreement with the statement "I think science communication should be integrated in academic training" and to the statement "I would like to know more about science communication". Additionally, the involvement of local municipalities contributed to a sense of recognition and appreciation, boosting sentiments of gratitude and appreciation, and consolidating the concept of Circular Education. The involvement with the community and the possibility to share their research and to stimulate science learning, it is an opportunity to give back to their communities. It is an opportunity for scientists to go back to their roots.

Finally, initiatives such as the Same Home Town programme appear to address the few opportunities for scientists to engage in outreach activities. This was reflected in the use of both green and yellow cards in the event as an answer to the statement "My institution offers me opportunities to engage in outreach activities". Because the programme requires only a day of participation, plus attendance to the webinar and workshop preparation, it reduces the time-related barriers that often prevent scientists from engaging. The strong dissemination efforts across research institutes, universities and other entities ensure that scientists are aware of the programme's existence and can access these opportunities. As highlighted by Professor Paulo during the event, beyond

providing training in science communication, it is essential to create opportunities for scientists to “put their hands on” and to practise science communication in real contexts.

Children’s engagement during the workshops was consistently highlighted both by scientists and teachers. As described in the literature on science engagement (Sowmya & Rani, 2025), hands-on activities tend to stimulate children’s curiosity about the world around them, a pattern that was clearly observable in our sessions. Several children expressed a desire to “be a scientist” at the end of the workshop, suggesting that participation in these workshops may positively influence their self-perception regarding science and their sense of what is possible for their future.

A particularly relevant finding is that 64% of the children met a scientist for the first time during these workshops. This becomes even more meaningful when the scientists come from the same hometown as the children, offering a relatable role model and reinforcing the idea that scientific careers are a possibility for children “like them”. In addition, because the workshops covered different scientific areas, as shown in Figure 7, children were exposed to the diversity of scientific fields, helping counter the misconception that there is only “one type” of science that is done in the laboratory. The presence of both male and female scientists further contributed to challenging stereotypical images of who can be a scientist, moving away from the traditional portrayal of the “crazy-looking” male scientists who work in a lab. Early exposure to science and scientists is therefore widely recognised as a factor that can shape aspirations and broaden children’s understanding of who belongs in science.

An additional point of significance is that these workshops took place in fifteen municipalities classified as priority or super-priority, according to the criteria described in **2.2.** This geographical focus aligns with Native Scientists’ mission to promote science in underserved communities, ensuring that children who typically have fewer opportunities for science engagement are reached first. Delivering the programme in these contexts reinforces its commitment to equity and to reducing disparities in access to science.

Returning to the methodology of the programmes, presented in the Introduction, and grounded in Relational Education and the Science Capital Teaching Approach (Hickey & Riddle, 2023; Archer et al., 2015), it becomes clear that these frameworks help explain not only the strong engagement observed but also the fact that many children reported learning new things during the workshops. By fostering meaningful connection with scientists and introducing scientific ideas within a context familiar to children and adapted to their cultural context, these approaches create conditions for learning that are more

natural, relevant, and memorable. They also reinforce children's scientific identity and contribute to reducing inequalities in access to scientific experiences.

Teachers further emphasised the importance of initiatives like this. They noted that meeting a scientist who once studied in the same classroom allows children to see someone "like them" who successfully pursued a scientific career. This visibility can influence their aspirations, expand their sense of future possibilities, and counteract the perception that science is distant or inaccessible. Teachers also highlighted the value of programmes that bring science directly into schools rather than requiring schools to travel, ensuring that access does not depend on resources, geography, or socioeconomic background.

Throughout this project, it was possible to observe the importance of science communication and active engagement in science outreach activities. On the one hand, for scientists, the programme responds to their desire to learn more about science communication and to the lack of opportunities available inside their institutions. Participation also generated feelings of gratitude, excitement, and renewed motivation for their own science research, reinforcing the personal and professional value of engaging with the public. On the other hand, children were exposed to science and to scientists in accessible and meaningful ways, promoting equitable access to science, challenging stereotypes related to scientists, and strengthening their sense of self-efficacy to "be a scientist". It also highlighted the importance of relatable role models in shaping children's perceptions of their future and broadening their horizons.

When it comes to the limitations of the work, they were present at various stages during these months. During the training sessions, the online format occasionally made the experience less engaging for the scientists, and not all scientists attended, despite our efforts to encourage participation. Moreover, not all scientists who attended the session completed the feedback form, possibly creating a bias in which only interested or motivated scientists share their feedback, possibly skewing the results towards a more positive experience. When managing the workshops, communication challenges were a recurrent bottleneck. Delayed or absent responses from both scientists and teachers affected the scheduling process and created uncertainty regarding workshop preparation, resulting in some confusion. These communication gaps were reflected in missing materials, such as feedback sheets, unsigned children's image consents, or the absence of pre- and post-workshop sheets. The physical format of these documents also revealed a struggle, as teachers needed to scan or photograph the materials before sending them to our team. To overcome this difficulty, we offered the option of sending

these documents via post mail. In addition, some logistical constraints also affected workshop implementation. Delays in sending the kit, or incorrect addresses provided to the team, meant that some schools didn't receive these materials in time for the workshop. Lastly, difficult communication with municipalities resulted in the absence of photographs from certain sessions, reducing visual documentation. Limitations were also present when organising the event. Dissemination could have been broader across different departments within FCUP, rather than concentrated mainly in Biology, which may have restricted the diversity of the audience. Furthermore, the participants who attended may reflect a self-selection effect, meaning that those present were likely individuals already aware of or interested in science communication as a possible career path, rather than students who might be unfamiliar with this possibility.

Some aspects of this project could be improved to ensure a more engaging experience and to maximise impact. The training sessions would benefit from more concrete examples of activities, and clearer demonstrations of how scientists can simplify their research topic. It would also be valuable to explore ways of making the session more interactive, encouraging scientists' participation, so they can better understand and integrate the topics introduced. In addition, emphasising the importance of completing the feedback form at the end of the session could help increase responses and reduce self-selection bias in the evaluation. Regarding the organisation of the workshops, establishing a more structured and consistent communication flow with both teachers and scientists could be advised from the beginning. It could help prevent delays in scheduling and reduce uncertainty. To strengthen impact measurement, it would be important to simplify both the implementation and collection of feedback sheets and pre- and post-workshop sheets, while also offering teachers more accessible ways to return materials, which may reduce the loss of data. Furthermore, ensuring that school addresses are accurately collected at the beginning of the school year could help avoid delays in kit delivery.

Finally, improvements could also be made when organising the event. A broader and more diverse dissemination strategy within FCUP would help reach more students with different academic backgrounds. Collecting feedback from participants would also be valuable to assess whether the session's key messages were effectively communicated.

Chapter 5: Conclusion

In a world of rapid dissemination of information, it becomes increasingly difficult to distinguish what is true and what is not. This demands skills of critical thinking and analysis that are closely linked with scientific literacy (Roche et al., 2023). Citizens in Portugal, however, report low levels of it when compared to other countries, creating a gap in these essential tools (IAVE, 2023; OECD, 2024). At the same time, a decline in interest in scientific subjects among young people, together with reduced scholarly success in these areas (Archer et al., 2013; Steidtmann et al., 2023), reinforces the need to rethink how science is presented and, above all else, accessed. In this context, science communication can play a key role in promoting scientific literacy and sparking curiosity for science by engaging our society in a meaningful way with science and scientists.

The ROOTS project contributed to the mission of Native Scientists by expanding opportunities for children to meet scientists with a similar background, and for researchers to engage in science communication activities. The four main goals of the report were accomplished: (1) delivering the training in Science Communication with Children, (2) implementing 21 interventions from the SHT programme, (3) implementing one in my own primary school, and (4) organising an event between Native Scientists and FCUP.

Results showed highly positive feedback overall from scientists, children, and teachers. Scientists rated the training 4.9 out of 5, having stated they learned new things and were more motivated and less nervous for their workshops. When it comes to the workshop, 98% of children reported liking “a lot” meeting the scientists, with "Spectacular” being the most used word to describe this day. Besides, 78% shared that they “learned a lot of things”, and 97% of the teachers rated the workshops as “very good” or "excellent". From the event, the importance of science communication and its integration into academic training was highlighted, as well as the importance of opportunities where students and researchers can put it into practice.

The importance of this report lies in responding to needs on both sides, scientists and children. For scientists, it offers a concrete opportunity to develop and apply science communication skills that are often absent from academic training, while also generating feelings of gratitude, fulfilment, and renewed motivation for their own research. For children, the workshops provided early and meaningful exposure to science and scientists, contributed to demystifying stereotypes about who can be a scientist, and

supported the development of their self-belief in their ability to do science. The fact that the programme was implemented in fifteen priority or super-priority municipalities reinforces its contribution to promoting more equitable access to science, particularly for children who might otherwise have fewer opportunities to participate in such activities. The event further underlined the relevance of these initiatives within higher education, by opening space for reflection on institutional opportunities and the place of science communication in academic careers.

Several limitations emerged throughout the ROOTS project, each pointing directly to areas of improvement. The online format of the training made the session less engaging for some scientists, suggesting the need for more interactive elements and concrete examples to sustain participation and support the practical application of communication strategies. As not all scientists completed the feedback form, this may have introduced a potential self-selection bias, highlighting the importance of reinforcing, at the training session, why completing the form is essential for realistic evaluation. Communication difficulties with teachers and scientists occasionally delayed scheduling the workshops and affected data collection, including feedback sheets, consent forms, and pre- and post-workshop sheets. Therefore, establishing a more structured communication flow from the beginning could help prevent these delays. Besides, incorrect school addresses and delays in kit delivery impacted access to these materials in some workshops, indicating the need to collect and confirm logistical information earlier. Finally, dissemination of the event was mostly concentrated in specific departments, so a broader communication strategy, combined with the collection of participant feedback, would help reach students from a wider range of backgrounds.

Overall, the ROOTS project reinforces the importance of science communication programmes such as Same Home Town in addressing current challenges in scientific literacy and access to science. By creating spaces where scientists can develop and practise communication skills, and where children, particularly in underserved contexts, can meet scientists, learn new things, and see themselves reflected in scientific careers, the programme contributes to a more inclusive and participatory relationship between science and society.

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