

Scicling – a Public Engagement Initiative

Section 1. Description of the Project

Scicling is a Public Engagement Initiative that aims to bring cutting-edge science to Secondary Schools to increase scientific culture in the learning communities. The approach is carried out in a simple and sustainable manner: **cycling**.

The initial funds were secured thanks to an 'Enabling Fund' awarded by Connecting Science, the entity leading all Public Engagement activities at the Wellcome Genome Campus (Hinxton, Cambridgeshire, UK). Together with the support of the Canary Islands Education and Universities Office, the first pioneering experience of Scicling has taken place in schools across Lanzarote and Fuerteventura ('Scicling: genética a golpe de pedal', Resolution - N°: 568/2019 - Tome: 1 - Book: 583 - Date: 21/03/2019 09:50:24)

Section 2. Background of the Project

Public Engagement has been confirmed as the best manner to raise awareness, first, to value what Science represents in terms of social progress and, also, to emphasise the essential role that plays in the society¹. However, according to the evaluation of the Spanish Science, Technology and Innovation Office, both Science and Technology are lagging behind all the other fields evaluated in 2017, only above Politics².

In nations like Germany, Denmark and United Kingdom, after the great economic crisis in 2008, funds for R+D have either been maintained or even increased significantly, while in other countries with traditionally less investment in innovation, such as Czech Republic or Poland, the funds provided to this kind of projects have been boosted progressively. In the meantime, **in Spain, the public funds for R+D have decreased up to a 25% from 2009 to 2016³**.

As a result, Spain has turned into a donor of talent out of its frontiers that is now settling abroad. In fact, the great number of people emigrating, due to this so called '**brain drain**', has translated into the recent creation of the Association network of Spanish Researchers and Scientist Abroad⁴.

Therefore, **Scicling** aims to slow down these dynamics from the basis, widening the scientific culture of the country among

teenagers and their educational institutions. This project ambitions **transforming this structural issue into an opportunity of encouraging scientific vocations** in Secondary Schools, using an innovative approach and an accessible language.

Section 3. Aims

In general terms **Scicling** pretends to generate shared spaces between Secondary Schools' students and teachers with scientists from different fields. Approaching Schools by bike, adds that component that, in its natural simplicity, breaks the preconceived notion of an incomprehensible and commonly misunderstood scientist. Moving in two wheels also leads to minimize the logistics where **an open, accessible and honest conversation among the participants plays a key role.**

Together with the Canary Islands Education and Universities Office, the following aims were set:

- **Promote** among students, especially among female students, the **scientific vocations** in STEAM areas (Science, Technology, Engineering, Art and Maths) by focusing on activities that stimulate innovation, creativity and problem-solving skills.

- Encourage an **active role of the educational community** in the Schools life and make the institution gain visibility in their environment.

- **Strengthen** projects connect with the **Agenda 2030 for Sustainable Development:**

- a) **Quality education** (objective n°4) bringing cutting-edge science in a comprehensible language to make scientific terms understood.
- b) Supports objective n°10, as it helps to **reduce inequities** by visiting remote areas where this sort of activities is infrequent.
- c) Furthermore, it aims to work on objective n°5, **gender equality**, since it encourages female students to play key roles in the different activities during the sessions. Also, objective n°17, **partnerships for the goals** inciting students to collaborate together as part of a team.
- d) Cycling between Schools already has already an impact on objective n°3, **good health and wellbeing**, and in n°13,

climate action, as it is a clean and environmentally friendly way of transport.

- Through the proposed activities, the development of **interpersonal competences** will be as well covered. In particular, oral communication skills, entrepreneur spirit and, also, the encouragement to work on the own personal attitude as a key component of a full integrated member of the community.

Section 4. Format, innovation and scientific-technical relevance of the activity

Each session was developed within a maximum, depending on the requirements of each School, of **three hours**. In all cases, the contents were adapted to meet the **Official Educational Curriculum**. The format of the sessions was structured in three intertwined parts:

1) Theoretical-visual introduction and hands-on experience. Using some audiovisual material that the Public Engagement Team at the Wellcome Genome Campus had produced, concepts on genetics and processes in which cutting-edge DNA based technologies are remodeling our understanding on infectious diseases were exposed to the students.

Once some background was provided, we proceeded in pairs or small groups to **extract DNA from strawberries** following an easy protocol. The methodology used common reagents such as water, salt, washing-up liquid and alcohol. Then, the **MinION⁵** (**figure 1a**), **the only portable sequencing device in the market**, was presented and used as a linker to briefly talk about the **Earth Biogenome Project⁶** and the **Human Genome Project⁷** (**figure 1b-c**) and how genomics is being currently used to tackle one of the most devastating diseases: malaria⁸ (**figure 1d**).

2) Group activity. After having raised curiosity among the students on genomics and its use to prevent diseases, the '**Malaria Challenge**'⁹ did allow to work in teams and to use active-learning methodologies in the classroom.

Briefly, each **group of 5 or 6 students** works as if they were the Council of a Spanish Foundation that funds projects to fight against malaria aiming to reduce the mortality and the economic and social burden associated to the disease. Each group needs to choose a speaker to present their decisions in front of the

class, a scribe to write down their reasoning and an accountant, to ensure they selected projects fall within the given budget.

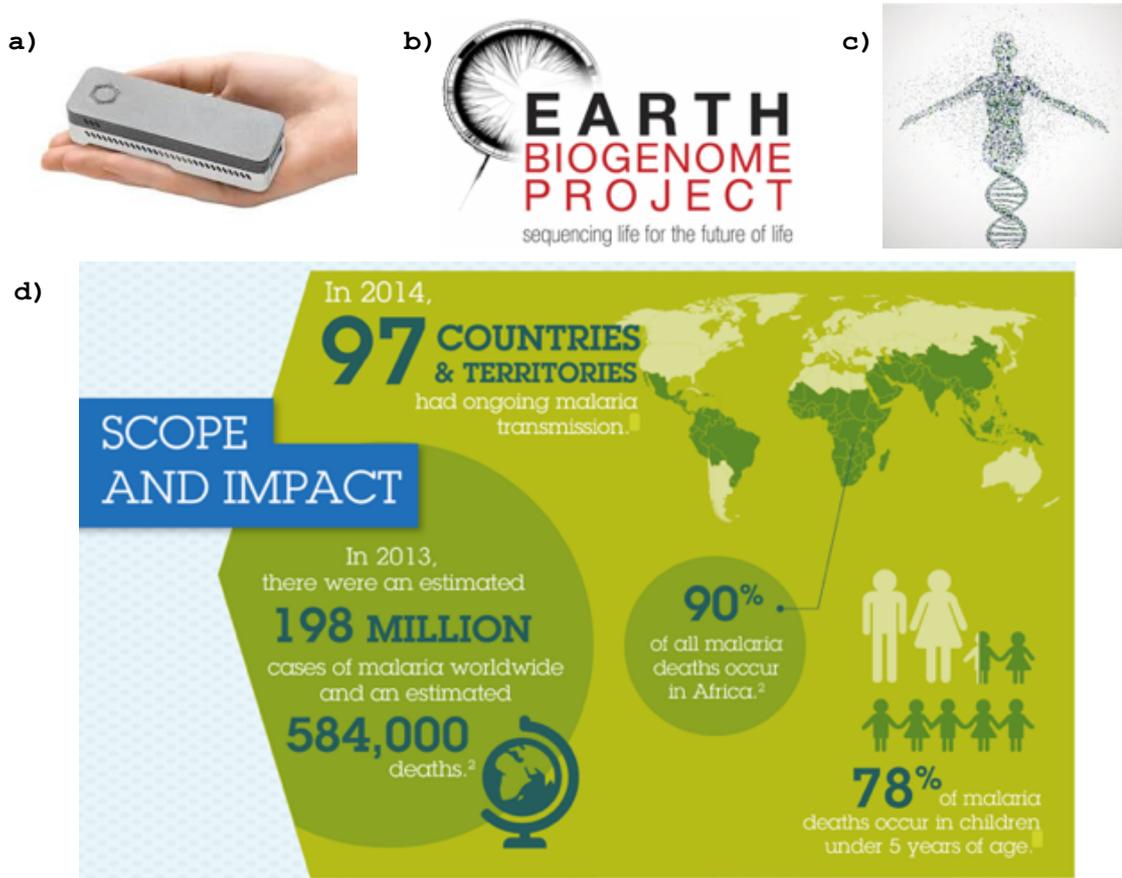


Figure 1. a) Portable sequencing device (MinION); b) Earth Biogenome Project; c) Human Genome Project; d) Malaria data sheet.

The funds of the foundation are limited to **£20 million** and could be assigned to **10 proposals** that are presented in already prepared sheets. Among these, **all of them real**, they can find from distributing mosquito nets in Nepal (£250.000) to a project of genome sequencing of parasite populations (£10 million).

3) Personal experience. Here, sharing **the life experience of the researcher could be also inspiring for both students and teachers.** Having lived in 8 countries in three continents, accumulated experienced in education settings in all of them and with an enthusiastic communication, it was highlighted the uniqueness of each career path, and **the importance of the personal attitude** as much as the knowledge or the skills.

Section 5. Budget and joint financing

In this first pilot experience in Lanzarote and Fuerteventura, **Scicling** has **relied on the 'Enabling Fund'** from

Wellcome Genome Campus Connecting Science and the support from the Education and Universities Council of the Canary Islands, with an **initial budget of 1733€**. The use of the funds is displayed in **table 1**.

Also, recently, this initiative has won a **Shark-Tank award** by the International Mentoring Foundation for the Advancement of Higher Education (**IMFAHE**) and has already **secured a second round of the 'Enabling Fund'** in collaboration with Dr. Kim Judge and 'Sequencing in a suitcase' to reach underserved areas in Norfolk (UK).

Flights	Accommodation	Allowance	Bike Rent	Promotion	TOTAL (€)
154.72	556.49	343.50	249.22	279.29	1583.22

Table 1. Detailed expenditures during the pilot study. All amounts are shown in Euros.

All of these funds are contributing significantly to consolidate the project, first bringing it to Lanzarote and Fuerteventura but also expanding to other areas in both Spain and UK.

Section 6. Impact evaluation: qualitative and quantitative

The STEM Ambassadors team in the UK has developed a **simple and fast method** to gather information, both **quantitative and qualitative**, of the impact that public engagement activities have on the audience. This evaluation approach consists of an **'impact target'** with four questions and four possible answers for each of them (**figure 2a**). It comes together with a collection tool that allows the evaluator to quantify the impact in the four categories in an Excel sheet that provides information not only of the total impact (**figure 2b**) but also whether the session has a different impact depending of the gender of the student (**figure 2c**).

Then, some days after the session, to avoid bias in students' responses due to the speaker presence, teachers did ask about the impact that **Scicling** had among the students in four aspects:

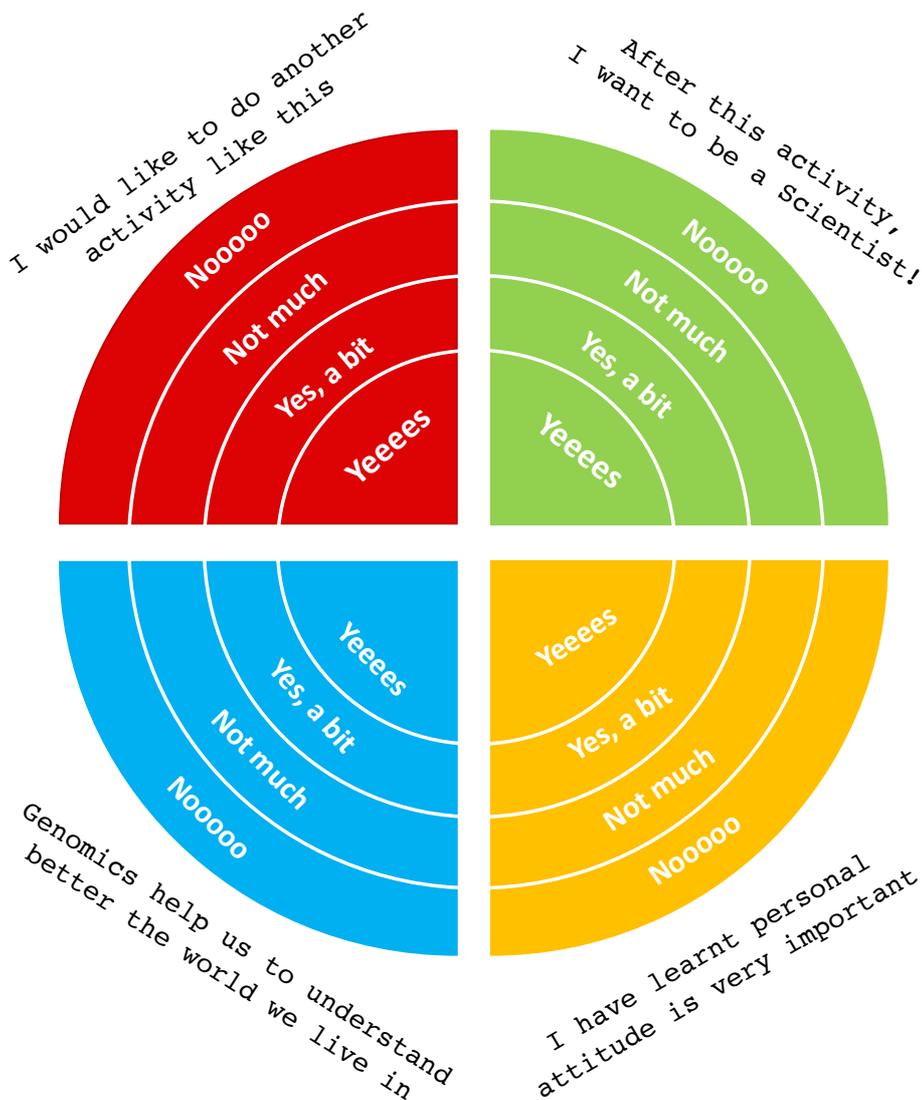
- **Engagement** during the session.
- Intention of following a **STEM-related career**.
- Relevance of **genomics** in our society.
- Importance of **personal attitude** in life.



a)

Tell us what you thought about today!

Please select how much you agree with each sentence



b)

	Total				Average
	Nooooo	Not much	Yes, a bit	Yeeees	
Engagement	0	0	39	306	3.89
Careers	74	61	132	75	2.61
Attitude	4	3	27	314	3.87
Knowledge	2	4	91	249	3.70

c)

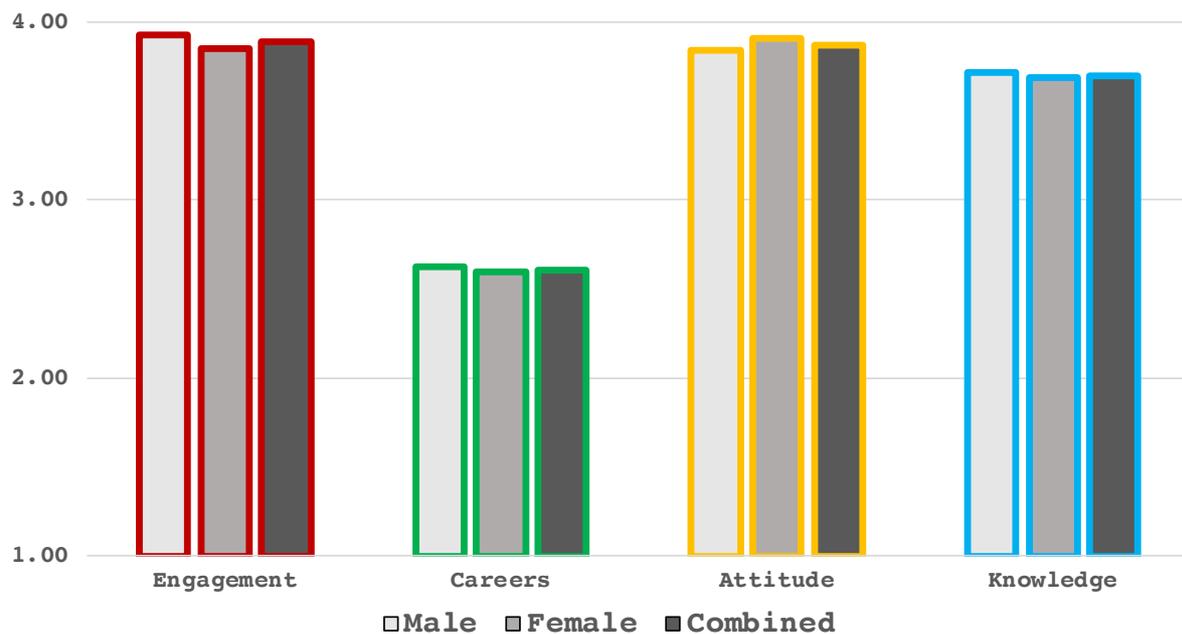


Figure 2. a) **Impact target.** Simple and useful tool to assess quantitative and qualitative impact; b) **Combined results of the collection tool;** c) **Average of the four categories evaluated.** Bars showing male (light grey) female (dark grey) and combined responses (black).

This method offers the possibility of assessing the impact of the activities, defining the demographic audience and gathering information to **improve the initiative in the future.** Furthermore, the evaluation tool certainly agrees with the general idea of the project: raise curiosity and scientific awareness **in a simple manner.**

In total, between Lanzarote and Fuerteventura, **8 Secondary Schools** were visited and a total of **513 students** participated in the sessions.

It is worth mentioning that only opinions from 348 have been collected (**figure 2b**). That discrepancy lays on the fact that originally the project only aimed to target 16 years old students (4° ESO year). However, due to the interest from the communities and the flexible nature of the approach, in all schools but one, the personal experience part of the session was shared with 17 and 18 years old (1° & 2° Bachillerato years) as well. Even in one of the schools, thanks to the interest of a teacher who had attended one of the sessions in the morning, **Scicling reached** an afternoon session with **adults.** Taking part these latter sessions in a more informal setting and only during 1 hour, it

was agreed with the teachers in all schools to evaluate the main 3 hours session with 4° ESO students.

As shown in **figure 2**, **100% of the students** (347/347) responded **positively to the possibility of having more activities** as the ones offered by **Scicling**; **97.9%** (341/348) have learnt that the **attitude plays a key role** in our life; and **98.2%** (340/346) are already aware of the **importance of genomic research** in our understanding of our world. The only section that almost 40% of the students showed negative feedback was the careers section. This figure is, on the one hand, positive as it highlights that **60.8%** (207/342) do consider **following a STEM-related career** (**figure 2b**), although, on the other hand, it also shows that there is room not only to increment the scientific vocations *per se*, but also raise the awareness among teenagers of the importance of Science in our society. Worth mentioning also, that in none of the four fields evaluated were significant differences between male and female students (**figure 2c**).

In addition to the impact in Lanzarote and Fuerteventura, it should be also highlighted that, thanks to an idea from Mike Norman, member of the Public Engagement Team at the Wellcome Genome Campus, a group of staff in Campus committed to, under the '**Scicling Challenge**' scheme, ride their bikes to commute, along the duration of the project. With a total of **2942 kilometres among 11 people**, this group has emphasised the potential of **Scicling** as a project with a wider impact than engaging with students and learning communities, as it can be also an active initiative to **promote healthy and environmentally friendly actions**.

All the resources used during the sessions and the data of the evaluations is available in the ongoing updates in the website of the initiative (www.scicling.org) and in social media (Twitter and Instagram [@Scicling](https://www.instagram.com/scicling)). In that way, all the participants and interested parties are fully aware of the progress of the project.

Section 7. Team and Institutional Experience

Scicling is an initiative created and developed by **Dr. Alejandro Marín-Menéndez**, a postdoctoral researcher at the **Wellcome Sanger Institute** (Cambridge, UK) who has thrown his knowledge and enthusiasm into public engagement. Alejandro has

a **double degree in Veterinary and Biochemistry** (Complutense University of Madrid, Spain), a **PhD in Microbiology** (Trinity College Dublin, Ireland) and a **MSc in Education** (University of Seville, Spain). His professional career combines an extensive experience in infectious diseases having worked in top institutions in Europe, America and Africa, having been involved in public engagement in England, Brazil, Spain, Morocco and Kenya.

The Wellcome Sanger Institute (www.sanger.ac.uk) has been the main single contributor to the Human Genome Project and is a global leader in genetics and genomics research. In addition, the institution values strongly support public engagement, considering scientist in Campus connecting with the general public as one of the pillars of their work. The Programme **Genome Campus Connecting Science**, led by **Dr. Julian Rayner**, is responsible of organising and accomplishing this mission that mainly aims to offer the possibility to the **wider community to explore genomics and its impact in Research, Health and Society**. Connecting Science carries out its activities not only in Campus but also organises training courses and conferences around the globe (www.wellcomegenomecampus.org).

Section 8. Conclusions

The first pioneering action of **Scicling in Lanzarote and Fuerteventura**, has allowed to evaluate the impact of the initiative and establish **attainable goals** in terms of **number of schools and students to reach in a manageable time**.

The **flexibility and simplicity** of the project offers the opportunity to estimate the budget to organise the sessions according to the number of weeks or months required, adapting to the needs of each educational community. Therefore, in an **ambitious financial plan, the project could visit 90 schools, engaging with more than 2500 students per year**.

Section 9. Acknowledgements

To my supervisor **Julian Rayner** for his unconditional support from the very beginning and share the idea of my time in Scicling is an important part of what we do. Also, to the Public Engagement team in Campus for launching the 'Enabling Fund' but also for sharing their experience, skills and resources: **Susan**

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To the Education and Universities Council of the Canary Islands Government and, in particular, to **José Manuel Sánchez Herrera**, that since the first contact threw his professionalism into the project to offer an impeccable logistic support. Thanks to the support of the Council, the schools were able to register their interest to receive the initiative and then organise a comprehensive itinerary.

To every single teacher from each school to offer their time and welcome Scicling: **África, Mariemi, Rosa y Guillermo** (IES en Altavista); **Juanma y Elena** (IES Haría); **Elena y Ana Nieves** (CEO Argana); **Elena y Fefi** (IES Agustín Espinosa); **Vanessa y Blanca** (IES Yaiza); **Erica** (IES Tías); **Drina y Guacimara** (IES Jandía); **Carmen, María Eugenia y Petra** (IES San Diego de Alcalá).

To every single student, Scicling is a better initiative thanks to each one of you.

Section 10. References

¹ Spanish Foundation for Science and Technology. Divulga S.L. Madrid, 2011

² Spanish System Indicators of Science, Technology and Innovation. MIC Editorial, 2017

³ 'Analysis of the resources dedicated to R+D contained in the National General Budgets approved for 2018' Spanish Confederation of Scientific Societies (COSCE)

⁴ www.raicex.org

⁵ www.nanoporetech.com/products/minion

⁶ www.earthbiogenome.org

⁷ Human Genome Project Image credit: Rehma Chandaria

⁸ www.sanofi.com

⁹ Malaria Challenge