



HiPATIA ALEJANDRIA

SCIENCE

TECHNOLOGY

ARTS MATHEMATICS

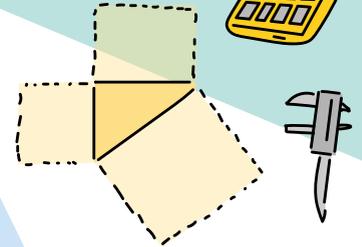
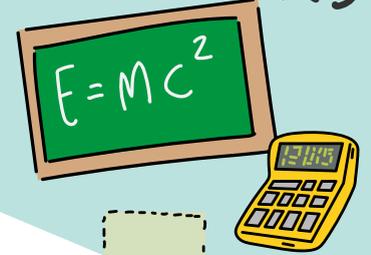


Yourself

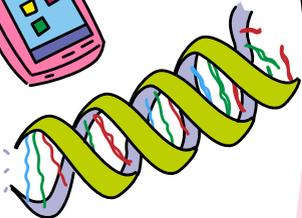
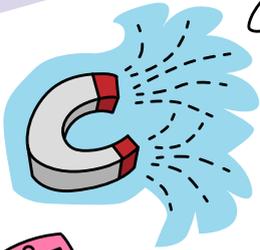
# STEM

PROFESSIONALS

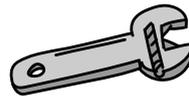
To INSPIRE young People



MARIE CURIE

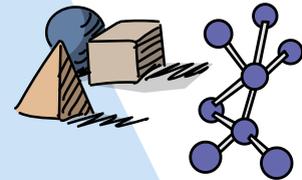


HEDY LAMARR



ENGINEERING

elhuyar



**Published by:** Elhuyar

**With the help of:** Project subsidised by the Department of Economic Promotion, Rural Affairs and Territorial Balance of the Provincial Council of Gipuzkoa.

**In collaboration with:**

CRECIM (Centre de Recerca per a l'Educació Científica i Matemàtica), Debegesa, Iraurgi Berritzen, Innobasque, DIPC (Donostia International Physics Center), CFM (Materials Physics Center), Department of Education of the Basque Government, Bizilabe, Danobat Group.

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This educational material has the approval of the Department of Education of the Basque Government: 02-07-2019.

The English version of this educational material has been co-funded by the Spoon project, Erasmus+ Programme of the European Union.

The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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# 1 STEAM Education for a better future

Behind STEAM (*Science, Technology, Engineering, Arts and Mathematics*) there is a paradigm shift that aims to promote science and technology education. It is not a term that has emerged out of nothing, it has arisen out of a trend in the educational world: the STEM concept. It is based on constructivism, on the philosophy of working on projects and on interdisciplinarity.

When we speak of professional worlds, we speak of STEM professions, whereas when we speak of education in sectoral disciplines, we speak of STEAM education. So, the intention is to point out that STEM can be used to address issues that are important to society (e.g. sociological, political or economic challenges) and that within this letter 'A' is the development of competencies that are not directly related to a particular discipline, such as teamwork, having a critical approach to information, etc.

So, in the 21st century, STEAM is much more than a recipe for creating technicians and engineers: it serves to confront reality with curiosity, and promotes eagerness to investigate. STEM professions extend into more areas than one might think. And in everyday life we also need the STEAM approach to make decisions and banish false beliefs and fake news, which are so dangerous.

Faced with the great challenges confronting today's society, we need STEM professionals to build a more sustainable world, to act with a critical eye, to respond to the great challenges confronting society, to revive local economies, industries, and education systems... and to be our own voice in the research world.

We all need STEM based on values: empathy, ecology, committed to social justice, and guaranteeing real equality between women and men, which is built from the perspective of women and men.

Let us promote STEAM as a space for education, cultural heritage, job opportunities, transformation and social participation.

Thanks to those of you who work developing STEAM education, thanks to the teachers who take their students on visits outside school, thanks to the professional volunteers who share their experiences with young students, to all those who want to receive young people in their laboratories, in their workshops or in their offices, to those who show enthusiasm, to those who work towards a better world and a better future for all, to the organizers of STEAM.

We hope you will enjoy this brochure.

# STEAM and STEM Professionals

STEM comes from the terms Science, Technology, Engineering and Mathematics. In order to encourage the incorporation of young people into this field within education, certain methodologies have frequently been highlighted: creativity and fun in STEM processes and activities, originality in the generation of knowledge, transversality and interdisciplinarity, etc. All this is called STEAM ( 'A' corresponds to Arts).

The absence of women has been detected in some areas of the STEM professions, especially in engineering (although they are in the majority in medicine and life sciences). The lack of women is most obvious in higher positions, which are the most important and best paid. Many factors influence decision-making about the future of young people, and enriching, continuing stimulation is necessary to awaken interest in the science and technology fields. Through this initiative, we encourage institutions, STEM volunteer professionals, educators, technology and research centres and companies to move closer towards this interesting scientific and technological world. We believe that this would be good for society, for the STEM environment and for the people who adopt this approach to encourage greater diversity and inclusion.

A negative image of STEM professionals is widespread in society: a half-crazy scientist (a white male) focused on his abstract ideas and absent-minded in his personal life, a genius who comes up with formulae that nobody understands and who

works alone. The technological-scientific world is broader and more diverse, and today working without a team is no longer viable. In any case, this image has a negative impact on some young people, because although they want to address the future through STEM, some find it difficult to see themselves reflected in that image. We know that this world is much more extensive, not only involving Einstein or IT nerds, or wearing a lab coat and looking at bubbles in a pipette through a microscope in a laboratory. Scientists must also read, research, translate, accompany, guide, educate, draw, document, test, manage, offer services, transport... and take into account the image of the science and engineering disciplines that we all want to redefine and project.

The equal participation of women in these fields is not merely an issue of justice; other points of view essential for scientific progress: gender, race, disability, age, etc., need to be taken into account.

We want to encourage companies, young people and society in general to close the gender gap, to break the glass ceiling, to work for a dignified life and to develop a scientific culture that allows for lifelong personal development. Without underestimating other branches of knowledge and culture, we believe that science is something worthwhile, because it can enable young people to contribute towards improving the world and provide them with a sense of fulfilment.



# What is STEAM?

More than just fashion and toys 

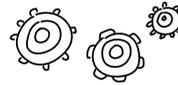
SCIENCE  
TECHNOLOGY  
ENGINEERING  
ARTS  
MATHEMATICS

FROM THE EDUCATIONAL POINT OF VIEW 

## STEAM is PARTICIPATORY



Technological



We NEED YOU!



...TO AVOID EXCLUSIONARY STANDARDIZATION



STEAM has the necessary values to face the CHALLENGES OF THE MILLENNIUM

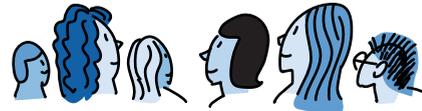
## THE SCIENCE OF CITIZENSHIP

SUSTAINABILITY  
GLOBAL JUSTICE



GLOBAL WARMING

IN STEAM EDUCATION,



WE MUST ENCOURAGE THE PRESENCE OF **GIRLS**, MINORITY GROUPS, VARIOUS RACES, MIGRANTS AND PEOPLE WITH A DIFFERENT SOCIO-ECONOMIC PROFILE.

### 3 STEM positioning

What is the attitude of today's young people towards STEM fields? What influences their career choices? What do they want to achieve, what do they look like, what do they dream about? Do boys and girls have the same interests? Why/ Why not? Is that natural for girls, and is it good? Can we improve as a society?

Digna Couso and Carme Grimalt<sup>1</sup> have analysed these issues in depth at CRECIM. They have developed a radial diagram comprising 5 branches (interests, desires, identity, capacity, self-efficacy) that takes into account aspects of three decisive areas for young people: SOCIETY, FAMILY AND SCHOOL (Couso Lagarón, D., & Grimalt-Álvaro, C., 2019).<sup>1</sup>

The intentions of a young person are not only focused on his/her professional future, but also on other aspirations such as social success, family perspective, etc. Society must offer jobs to respond to life's goals. In other words, work, in addition to being dignified, has to allow free time for life and friends etc. We cannot force anyone to choose a lifestyle or a career. Moreover, we cannot project an image in which working in the STEM field delays the goals and desires of personal life within a professional career.

That is why it is essential to promote the construction of STEM identities. Young people, especially girls, need references that highlight the contributions of women (people of different ethnicities, cultures, and socio-economic levels), not only in terms of professional success but also of life success. Let us highlight women

who work in STEM fields and are happy in their personal lives, not because they have received awards or been publicly recognized, but because they have felt professionally recognized and personally satisfied. We have to find references so that the girls can reflect and think "STEM could be for me, too".

The protection of the family and the environment is very important. Various studies relate the STEM capital of the family to the aspirations of the students. STEM capital includes aspects such as knowledge about or attitudes towards STEM fields in the family, and the existence of a family member working in STEM fields. In families with high STEM capital, many more young people participate in STEM studies. Consequently, STEM studies become a "hereditary" issue.

1- Couso Lagarón, D., & Grimalt-Álvaro, C. (2019) "Raising self-efficacy in STEM education to provide opportunities for all", In D. Couso Lagarón & C. Grimalt-Álvaro (Eds.), *STEM is for you. Experiences in raising self-efficacy from the STEAM 4U project* (p 103). Barcelona: Servei de Publicacions. Autonomous University of Barcelona.

Some strategies could therefore be to promote the STEM capital of the family, not regarding a young person interested in STEM fields as a “nerd”, so she or he can share her/his abilities and successes/achievements with their mothers, fathers and/or guardians (and thus receive recognition).

The third dimension of STEM’s positioning, after Society and Family, is School. The STEM field environment needs education to value students positively with enthusiasm and not treat them like freaks. The school should propose STEAM teaching aligned with the interests of young people; in addition to building STEM knowledge and developing STEM competencies, it could help students to build a realistic, humane and inclusive view of the STEM framework. To this end, it is necessary to lead, promote, encourage,

propose, organize visits to laboratories, invite women scientists or workers from the STEM environment... so that young people can learn from their experiences and gain an insight into this diverse, attractive world.

Teachers and educators must help young people develop their own effectiveness and overcome the effects of the environment, which are often not malicious, but can frustrate some projects. Vocations must have favourable conditions. To feel competent means to have successful experiences in the classroom, to receive recognition, to have real references, to know the STEM context of the professional field, to visit laboratories, to work in the classroom on soft skills (e.g. creative work and critical thinking), to listen to STEM professionals, to review classroom messages to overcome gender clichés

and to put personal effort above the final result. Overcoming sociocultural labels is important for those at the crossroads of life. People who work in education, formal, non-formal or informal, have to help students, without any imposition, to make their choices on the basis of knowledge. It is their future and their future needs STEM.

# SCHOOL

EVALUATION

POSITIVE SCHOOL REFERRALS



STEM ORIENTATION IN THE SCHOOL



STEM SCHOOL EXPERIENCES



TEACHERS' PERCEPTION



JOB ASPIRATIONS



SOCIAL IMPLICATIONS OF FUTURE EMPLOYMENT



REFERENCES FROM THE SCIENTIFIC COMMUNITY



They're REAL PEOPLE!

Help FAMILY MEMBERS' ATTITUDE towards STEM



# FAMILY

# SOCIETY

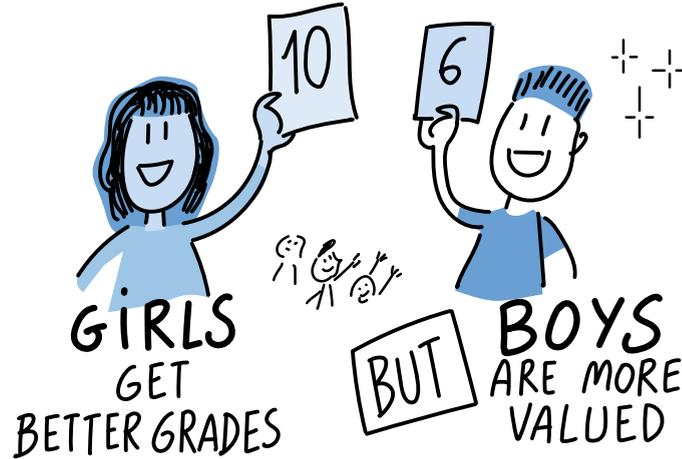
# 3A Capacity and self-efficacy

Girls get better grades overall and also get better grades in STEM. However, they evaluate their achievement modestly.

Boys, however, get worse grades but are not as demanding on themselves.

This situation is reinforced by the teacher's messages, for example, that girls get good grades because they work hard, and praising the "talent" of boys stressing that they get good grades without working hard (not proven, but suspected).

## QUALIFICATIONS



## 3B Identity

The stereotype of the professional scientist is an intelligent white man, highly successful and greatly attached to the science field (probably based on the mythification of Einstein's character). This stereotype discourages many young people from taking the STEM path, since they do not identify with that image of the STEM professional and do not see that there is scope for people like them. Other causes related to gender roles may be linked, for example, to the fact that there are more women than men in care professions such as nursing and medicine. Likewise, the view that in high school it is very difficult to pass STEM subjects holds back girls and all the less academically capable students, who in general underestimate their abilities.



## 3C Intentions

According to studies, many young STEM students have family members who work in the STEM field, so based on this role-model, in addition to knowing what professional STEMs are, they believe that it is important for their family. In addition, these close references are very close culturally and socially (they can be women, ethnic groups, etc.). In short, these young people come from middle socioeconomic backgrounds and from a high STEM family capital. It follows that strategies such as promoting STEM capital of families or contact with STEM culturally/socially equal professionals can positively influence their purposes.

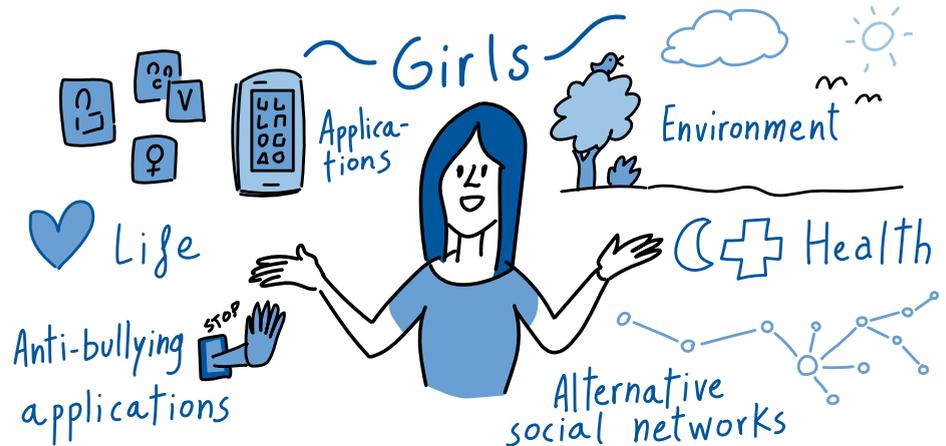
### They want to study STEM



- Young people with a **HIGH** socioeconomic level.
- With acquaintances from the STEM environment.

## 3D Interest by STEM zone

Generally speaking, females are more interested in the usefulness of STEM practice (objectives with which it is carried out), in its relationship with or impact on society and, in particular, in the improvement of people's living conditions. For example, they are attracted to technological applications that allow them to relate to each other, and which will allow them to work on aspects of real life that affect everyday life, such as the design of a mobile app designed to detect bulimic habits. Topics of interest include health and the environment.



Males, in general, show a greater interest in STEM processes and products regardless of whether they are useful or not; they are attracted by the competitive aspect. For example, they value technological applications related to competitive gaming. Thus, contests, robot fights, etc. are very attractive for males, and this in turn may discourage girls from participating in this context.



# 4 What would be the most appropriate message for young people with respect to STEAM education?

What do you think about it?

I want to know what your point of view is.

- As an example of participation:

You can do it if I support you.

- Access to STEM people with similar interests.

- You're not alone.
- We need girls!
- Being a scientist is an attitude of life.
- We need you to build a society with scientific culture.
- Come to our world.

Science and technology professionals are normal people.

- Don't worry and ask if you want: content, personal things...
- Seize the opportunity.
- Have fun, this is not a test!

Those necessary for scientific work  
- cooperation, respect and empathy-  
are resources for life.

- Don't set any limits!
- Even if STEM is not professional, it is important for everyday life.

From researchers:

- "I also fail"...
- Show errors
- Speaking from one's own culture
- Say "exploit your interests"
- You don't have to be "brilliant"

The STEM attitude  
is beneficial  
to society.

CONFLICTS AND PROBLEMS  
ARE A NATURAL PART  
OF LEARNING

- If you like it,  
it could be  
your profession.
- STEM is a world  
full of jobs.

Criteria for the composition  
of "healthy" groups  
(not competitive, elitist,  
or "for the photo"...) )

**YOUNGSTER,  
PROTAGONIST!**

- Enjoy all your hobbies  
(also STEAM).

- STEM is fundamental  
in order to stipulate  
its own criteria and build  
a more critical society.

When you know  
the basics,  
what else do you  
want to learn?

# 5 Five aspects to improve STEM positioning

## 1.- Start with the youngest ones

Promote a good STE(A)M education from the earliest ages, acting from a gender and discipline perspective at all times.

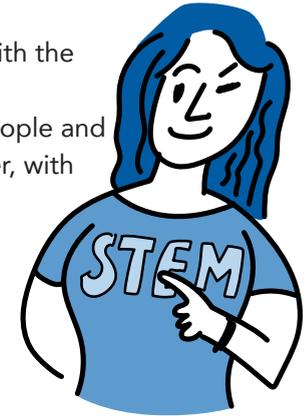


## 2.- Promotion of STEM identity

Enhance the positive image of STEM professionals so as to identify better with the STEM fields.

Facilitate exchange between young people and STEM professionals of the same gender, with similar life interests, ethnicity, etc.

Draw attention to the contribution by people who move away from stereotypes to STEM, but avoid highlighting only those cases in which STEM has been a success.



## 3.- Promotion of STEM practices in the family environment

Offer young people the opportunity to demonstrate their abilities or successes in STEM practice so that their parents and/or tutors value them.



## 4.- Improve the perception of self-efficacy in STEM fields

Promote successful experiences in the practice of STEM, using different strategies in the classroom.



## 5.- Inform about the value and diversity of the STEM fields

Inform about the added value and diversity of STEM studies. Define the contributions of STEM to improve people's quality of life.

DENTIST 

ENGINEER 

TEACHER 

Geographer 

PHARMACY 

\$  €

ECONOMISTS

MECHANICS 



HERBORISTERY

Biologist 

PHYSICS 

# 5A Early involvement...

## Early start and continued Action

- Before the age of 10 (preferably in the kindergarten stage) to avoid early disapproval.
- Avoid stagnation during the transition (10-14 years).
- In the stage after the age of 16, reinforce specific sectors (for example women for engineering).



## ... and with a gender perspective

### With a gender/intersection approach:

- Inclusive language (e.g. characteristics vs verbs; effects vs products; value vs cost...)
- Visual inclusion (presence of females and males in equivalent tasks)
- Contextualization and focus on practical objectives (e.g. creation of well-being)
- Cooperative and competitive environments.



# 5B STEM Identity Promotion

Enhance the positive image of STEM professionals so that students can identify more easily with STEM fields. Show STEM professionals as a normal reference, as people leading normal lives (in terms of hobbies, academic failures and successes, family and friends, etc.).

Talk about STEM fields, but also about STEM grounding (what this topic is like, what it was like before, what we want it to be like, what each one can do to improve it...).

Show compatibility between STEM fields and females' identities, but without being FRIVOLOUS! Facilitate the exchange between professionals and STEM youth of the same gender, with similar interests in life, ethnicity, etc.

Draw attention to the historical and current contribution of women and other groups, avoiding stereotyped images, without exclusively highlighting the success cases.



# 5C Getting used to STEM

## Ideas to encourage STEM family practices:

- Propose family dialogues, create intercultural materials for families (iconographic, translated...). Use APS methodologies, data collection in families, etc.
- Make families aware that they influence the professional future of their sons and daughters.
- Offer young people the opportunity through STEM to show their abilities or successes to their families so that their parents and/or guardians value them.

## Make STEM more familiar and an everyday matter:

- Use programmes of great personal presence such as tutoring, mentoring, sponsorship, etc.
- Show local STEM: professionals they are familiar with, people they know, etc.



Promote family conversations...



## 5D

# Improving the perception of self-efficacy in STEM

Promote successful experiences in STEM practice by incorporating and using personal skills and particular interests in the classroom.

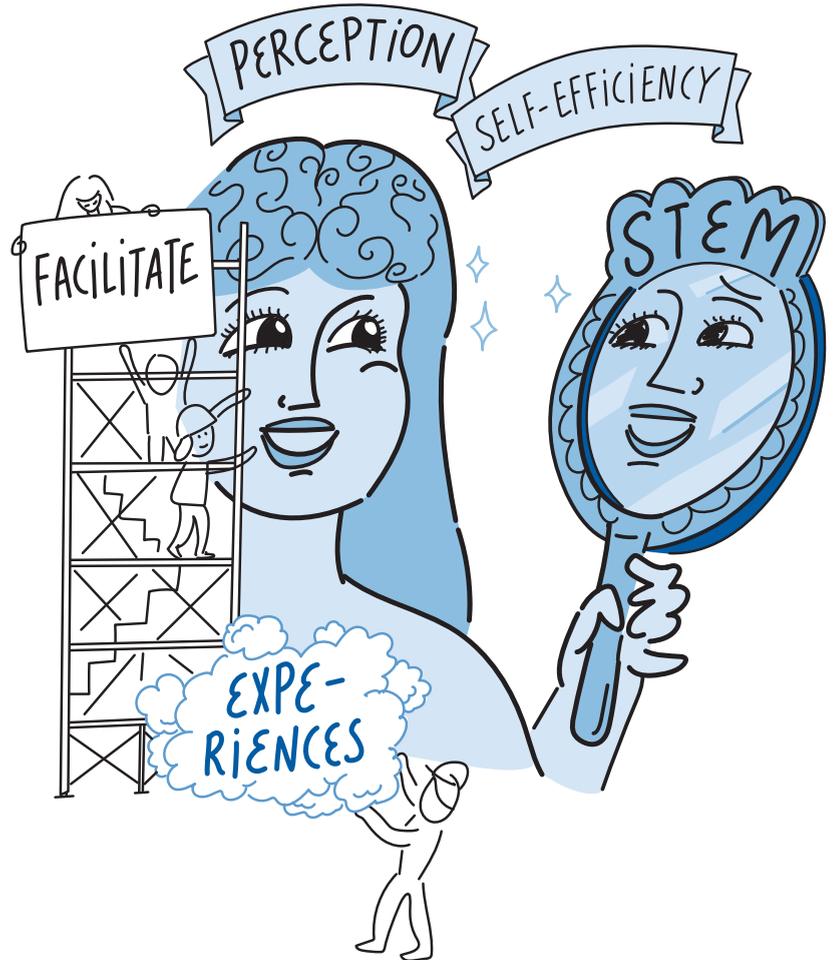
Offer activities to students with low socioeconomic backgrounds or from low-income families. Highlight the idea that anyone can contribute. Think about how students can overcome the following steps in the proposed activities (scaffolding construction).

Use cooperative educational methodologies to build their own image and enhance the prominence of young people, instead of being competitive: applications, job-shadowing programmes, scientific volunteering, participation in science fairs and workshops, etc.

Decriminalize error: it doesn't matter if we fail! Create a good atmosphere so that students can speak without fear.

Help them reflect on their own abilities (metacognition): "Can you see what you are doing?" "Look at the difference between the first prototype and the final one!"

Take care with respect to the messages that are communicated: value the process more than the final result, or value the strategies used to overcome difficulties, or give options for improvement, or make comments with a positive content ("you've tried...", "I like what you've done...").







## 6 Challenges and references of STEAM education

Learning science, technology, engineering and mathematics (STEM) is insufficient to meet the expected demand for work in this sector. Governments and institutions are concerned. It is also worrying that the profile of STEM students is too homogeneous, since women, the working class and minority ethnic groups are not represented. And this situation has a negative effect on the economy. All young people should develop minimum STEM skills so that, as citizens, they can address the great challenges of democratic society, such as the UN's Sustainable Development Goals. In order to tackle these challenges, the STEM field plays a leading role, both in the causes and in the search for solutions. Whatever the world of the future will be, it is clear to us that we cannot renounce all of us together being able to decide on the basis of democratic will. To this end, it is necessary to improve the scientific literacy of all social groups.

The majority of young people have great aspirations, but not related to STEM fields.

The majority of young people between 10 and 14 years of age have quite high aspirations of success, social relevance, etc. However, very few intend to become STEM professionals (about 15%).

The majority of girls and boys between the ages of 6 and 9 say that they learn interesting things in science lessons. Students have a positive image of scientists' contributions towards improving the world and their parents believe it is important to learn science. However, after asking them if they intend to work in the STEM fields, most children aged 10-14 totally reject the idea.

Why does this happen at puberty? First of all, we have to reinforce young people from Primary Education onwards, because when they reach the age of 9 it may be too late.

Family "scientific capital" is fundamental.

We are aware that families have a great influence on the aspirations of students. A key factor is family "scientific capital".

When we talk about scientific capital, we are talking about qualifications related to science, understanding, knowledge (what we know about science and how it works), interest and social relations (for example, knowing someone who has a science-related job).

The scientific capital of the family is distributed differently among social groups. The highest levels of scientific capital usually belong to the middle classes. Lower and upper class families have low scientific capital. Young people from families with high scientific capital have been found to have a greater propensity for STEM professions than young people from families with low scientific capital. This situation makes it difficult to break the homogeneity of the STEM professional group.

One of the consequences of STEM having a low scientific capital is not knowing the diversity of professional paths that STEM can have..

This situation generates a very narrow view, since young people can deduce that STEM studies lead to work mainly as scientists, engineers, STEM teachers... so many young people consider that STEM "is not important to me" because it does not satisfy their concerns.

The stereotyped image of STEM professionals and STEM studies excludes many young people.

Young people believe that STEM professionals are "very bright", "hard-working" and "freak/geeks", so they conclude that "I am not like this, so this is not for me". It is unlikely that anyone who does not consider him-/herself one of the "smartest" in the school (most of them) will want to study science, even if they like science and get good grades.

Also, the image of science career professionals is a problem: male, middle class, and white.

It is easier for a student to express his desire for science if he is male and white and has a high or very high scientific capital, since he is able to identify with that image.

Therefore, it is not so likely that a student can practice science "for me" if she is a woman, of low cultural capital and a low socioeconomic level.

In short, the problems of equity and, above all, those of gender are evident, even at an early age.

Girls choose STEM studies less than boys, but a higher percentage of girls have more enjoyable science in their childhood. Girls are very much in favour of studies related to the arts and the humanities.

The stereotyped image of STEM professionals alienates young people who do not identify with it. Thus, girls who define themselves as "feminine" (very feminine) rarely take up STEM studies. Girls who take up studies related to STEM are usually very academic and may be considered "not feminine". These "feminine" girls who decide to study science at 10-11 years of age drop out of those studies or modify them as time passes.

In the case of minority students, the factors that hinder the development of scientific objectives are aggravated. On the one hand, because of their differences, and on the other, because they have more difficulties in accessing STEM studies. This is particularly so if personal and social factors are combined, as in the case of women of Latin origin.

# 7 Inspirational encounters

In order to encourage STEAM vocations among young people, several institutions are making various proposals for activities. For other organizers and educational players, role models that can be adapted to the needs of each one.

Some projects are very local and attach value to the environment (0 km STEM), such as 'Looking for a Plan for the region' (28 km). Others are more focused on visits to specific, unique centres or facilities, such as the CFM and the DIPC. Some activities are related to long-distance projects such as 'FLL' or 'Bizilabe'. Many carry out interviews or organise meetings and gatherings with scientists, sometimes at a very high international level, such as 'Galdera bat zuretzat' (I have a question for you). In all of them, however, special attention has been paid to gender equality, ethnicity, social classes, etc., as in the case of 'Neska Power' (Girl power). The intergenerational relationship is evident in other initiatives, including 'Aitona-amonekin Unira' (With the grandparents to the University). The learning derived from the exchange of ideas is highlighted in others such as: 'Ekintzaile-Hitza' (Entrepreneurial world) and 'Parekoen topaketak' (Meeting of peers). Finally, learning by doing is evident in initiatives such as the 'Congress of Small Researchers', 'Teknoliderrak' (TechnoLeaders), 'Zientzia-Attack' or 'Enpresa katak' (Business tastings from Bizilabe). Although they have different characteristics, they have something that unites them: they are all collaborative.



# Elhuyar Zientzia Azoka: LABORATORY REVIEWS



**Organisation:** Elhuyar

**Original project name:**

Zientzia Azoka: researchers as youth advisors.

**Duration of the meetings:** 2 or 3 hours.

**Venue:** STEM professional work centres.

**Description:**

Each group of young people working on the Elhuyar Zientzia Azoka project gets in touch with a volunteer researcher at the university.

The young people visit the researcher in his/her laboratory or workplace and, after learning about the researcher's activity, they focus on the project in hand; the researcher gives them suggestions and is asked to talk about real experiences.

Prior to that, the researcher is asked to explain their work to the young people. Sometimes researchers do some other activity.

The young people then explain to the researcher what projects they are working on. The researcher mainly helps the young people to give a more authentic dimension to the methodological aspect and to the project.

**Strengths:**

- Starting from the personal relationship, not from the contents.
- Connecting schools with STEM professionals.
- Breaking stereotypes: appearance, lifestyle...
- Possibility of prolonging the relationship (satisfaction).
- Small groups, closer relationship.
- Responding to the needs of young people.
- Volunteering of researchers.

# GIRL PWOWER

ALL WOMEN



**Organisation:** CIC nanoGUNE.

**Original name of the project:**

Zientzia bada nesken kontua.

**Duration of the meetings:** Workshop of approximately 3 hours.

**Venue:** CIC NanoGUNE Headquarters.

**Description:**

Secondary and Sixth Form students. Led by nanoGUNE researchers, girls are “nanoscientists” for one day.

In groups of 4-5 students, with the help of professional researchers, an activity is carried out in NanoGUNE.

They are given a chip and a laboratory card, various measurements and experiments are carried out, and the results are recorded.

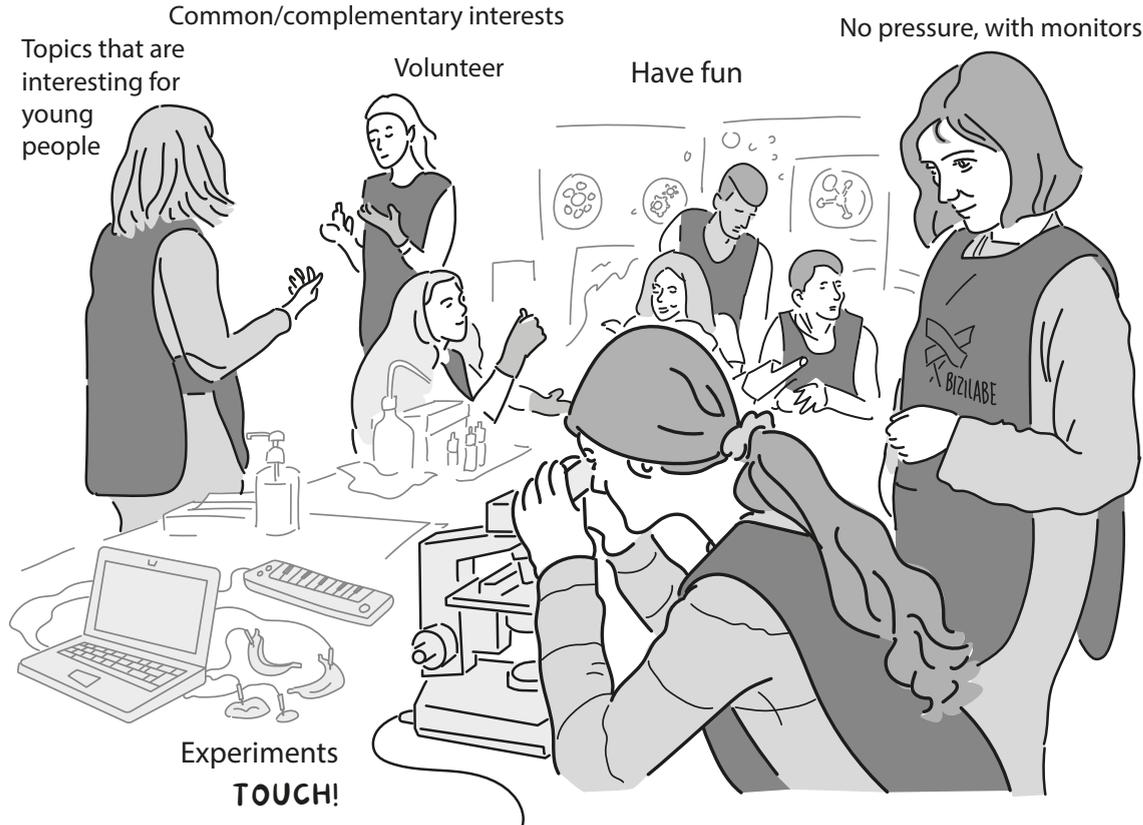
The participating girls have the opportunity to project themselves in a work environment of this type.

At the end they have a snack and are given an opportunity to talk about their interests.

**Strengths:**

- By participating without family and teachers, their self-confidence is reinforced.
- It is an encounter between equals, characterized by closeness.
- Gender roles are fully overcome.
- Participants get to know the researchers and their professional environments, tools, etc.
- It allows them to ward off “freakism”.

# SCIENTIFIC ATTACK in Bizilabe



**Organisation:** Elhuyar-Bizilabe.

**Duration of the meetings:** 5-6 sessions of 2 hours each.

**Venue:** Bizilabe

## **Description:**

These are monitored Attack Science sessions in which young people will experiment in areas of interest to them. They are very practical thematic monographic workshops designed to allow the participants to experiment, investigate, touch and perform in a collaborative environment; they also encourage the work of heterogeneous groups and provide an opportunity to participate in an enjoyable way. The activities have been designed by STEM professionals with semi-professional equipment.

The aim is to continue to deepen their projects by working on them in a friendly atmosphere, while working on self-confidence through capacity building.

## **Strengths:**

- Citizen co-responsibility is encouraged.
- Identification of problems, proposal of solutions and development of projects.
- Possibilities are offered to practice science in a freely.
- Students decide what to investigate.
- A critical society is fostered.

# CONGRESS of small RESEARCHERS



**Organisation:** Passionate researchers.

**Original name of the project:** Plant Diet.

**Duration of the meetings:** 1 month.

**Venue:** homes and schools.

## Description:

The action is divided into two sessions: in the first session, the students are given a challenge (for example, not to irrigate the plants or to irrigate them with different types of water: dirty water, distilled water, water with fertilizer or sea water) and are given an explanation (care of the plants and the measurement parameters are agreed).

One month later, the students explain the results obtained. In congress format, each working group presents its results to the whole class and the researchers. Finally, the conclusions are discussed. Between the two sessions, researchers and students exchange messages to clarify doubts or explain the progress made.

## Strengths:

- The students put themselves in the role of the researchers and learn how an experiment is carried out.
- They study methodology.
- The methodology is flexible: adaptable to all ages.
- Ideal for children.

# INTENSE Visit

Receiving the visits of young people and talking about everyday issues, fighting prejudices about STEM professionals...



**Organisation:** Elhuyar-Bizilabe.

**Duration of the meetings:** one and a half hours.

**Original name of the project:** Researchers once a month in Bizilabe.

**Venue:** Bizilabe

## Description:

Young people work as researchers and inventors in leisure activities, once a week. In this context, young people have the opportunity to spend time once a month with a STEM researcher.

In addition to motivating young people, the researchers contribute towards the inspiration of their projects. The monthly visit consolidates the relationship between the young group of people and the researcher, and as the young people progress through the projects, they can receive contributions, advice and suggestions from the researchers. In this way, professional STEM becomes a point of reference for young people, since it goes beyond the professional sphere to the personal sphere.

## Strengths:

- Creation of a forum for professionals in the STEM sector.
- Creation of a multidisciplinary forum.
- To obtain the support and involvement of companies and players.
- To establish close relations between young people and professionals.
- Giving visibility.

# KNOWLEDGE ABOUT THE R&D&i SYSTEM OF THE BASQUE COUNTRY



Training program  
STEM Professionals  
Science and technology content



TWO SHARES:

SCIENTIFIC LECTURES

LECTURES

STEM PROFESSIONALS

Universities, research centres and companies



**Organisation:** Innobasque. Basque Innovation Agency.

**Original name of the project:** Training programme FIRST LEGO League Euskadi.

**Duration of the meetings:** one and a half hours.

**Venue:** universities, research centres and companies.

## Description:

As part of the FIRST LEGO League Euskadi-Basque Country educational programme, two activities are carried out with students and STEM professionals:

- Scientific talks and guided tours in collaboration with companies and R&D&i institutions in the Basque Country. Young people learn STEM professions and contents in science and technology in real contexts with the help of STEM professionals who work in innovative projects of companies.
- Interviews with STEM professionals: young people have the opportunity to talk to STEM professionals so that they can share their ideas, draw inspiration and improve their projects.

## Strengths:

- STEM content for all students.
- Great projection in the media.
- Development of transversal competences as well as technological competences.
- It is very attractive for children and encourages them to talk about science and technology.

# ENTREPRENEURS FOR ONE DAY!



**Organisation:** Iraurgi Berritzen.

**Original name of the project:**

Elkarrekin eraikitzen

**Duration of the meetings:** about one hour.

**Venue:** Headquarters of players and schools.

**Description:**

Students are the protagonists of the learning process and work on values and skills related to entrepreneurship. In order to do this, the students are guided to investigate the reality of the socioeconomic players in the region. In the process we work with different players.

Through the situations/challenges that the students have to analyse, they visit different socioeconomic players in the region and get to know their daily lives. In the meeting, in addition to encouraging dialogue, the aim is to encourage access to the professionals' workplaces, thus generating experiences for young people.

**Strengths:**

- Teenagers see how professionals handle real cases and challenges.
- Internal knowledge of the economic environment of the Urola Valley.

# TECHNOLEADERS

Science and Technology subjects

Teachers

Researcher  
in contact  
with students

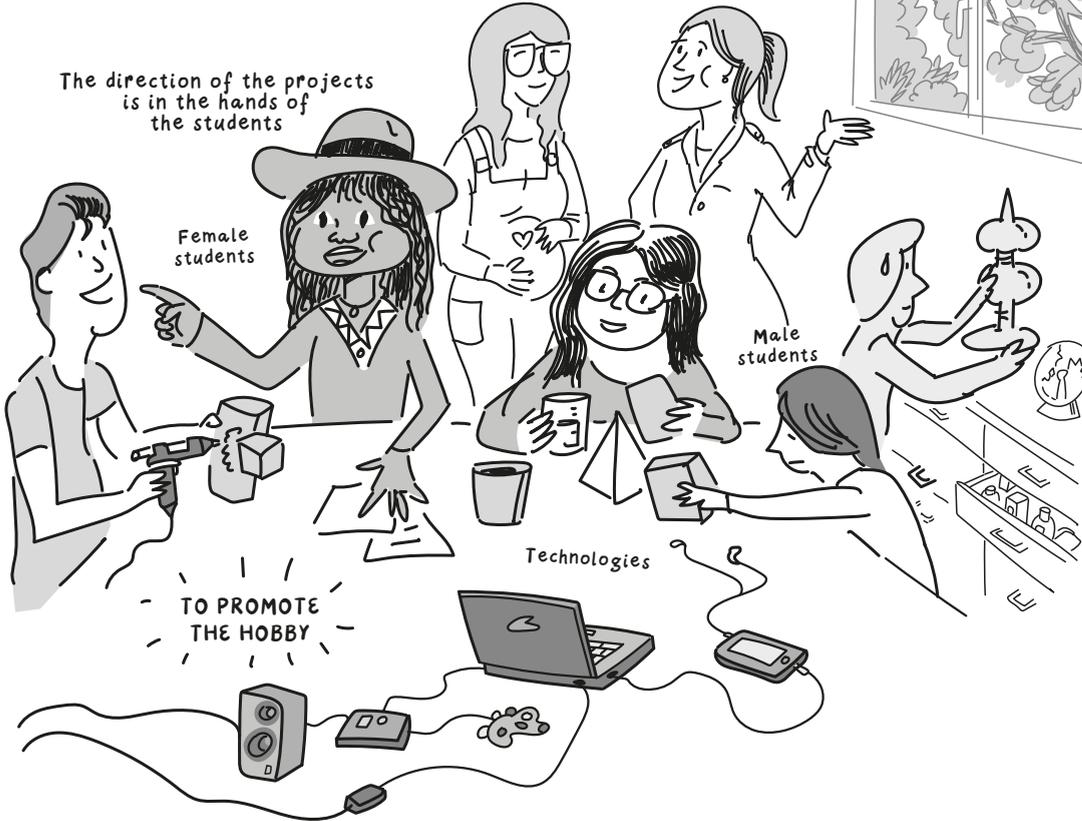
The direction of the projects  
is in the hands of  
the students

Female  
students

Male  
students

Technologies

TO PROMOTE  
THE HOBBY



**Organisation:** Iraurgi Berritzen

**Original project name:**

STEM in Middle Urola

**Duration of the meetings** 3 months.

**Location:** Schools.

**Description:**

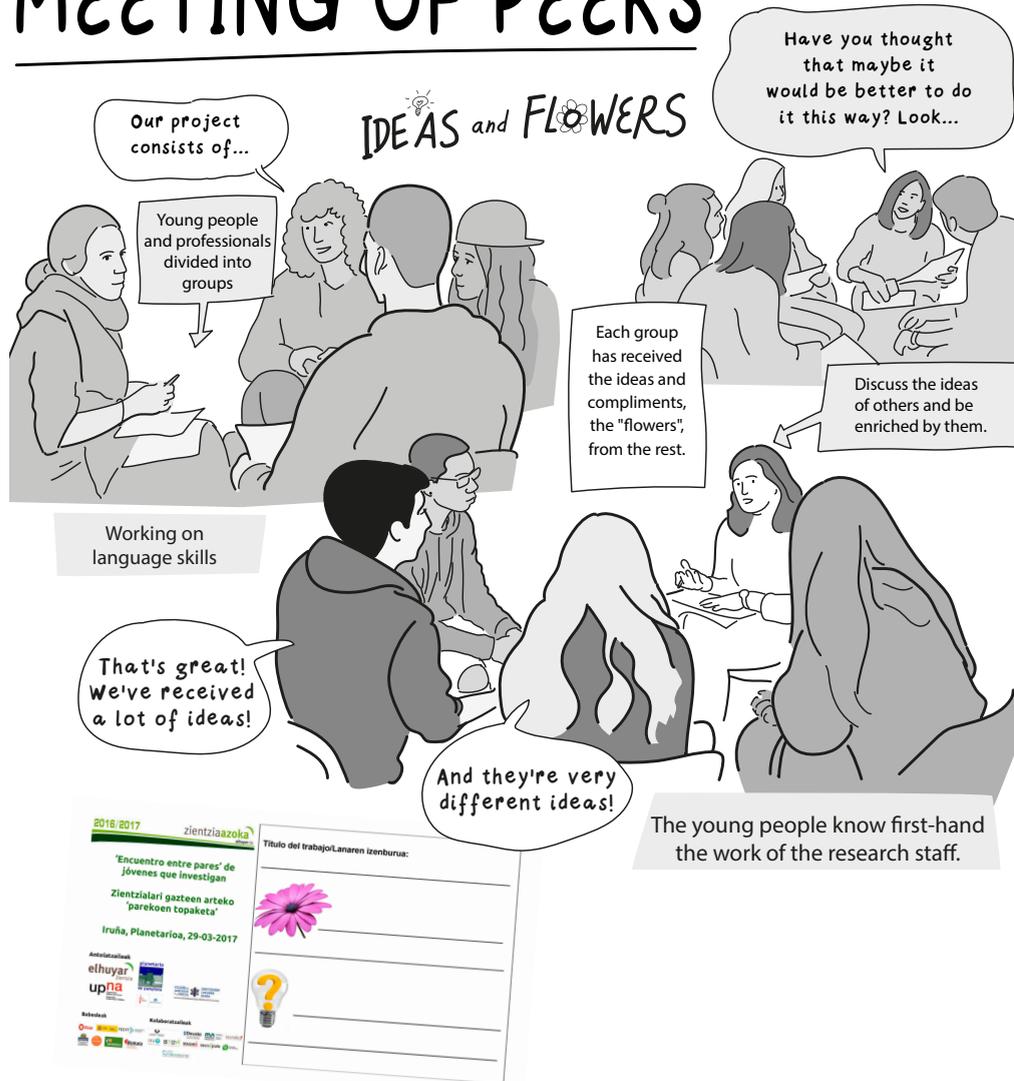
In the subjects of Science and Technology, the aim is to experiment in project leadership, turning the student into the protagonist of learning. In this way, the aim is to encourage students to develop a love of science, technology and research.

In the project, the researcher maintains relations with the corresponding classroom (both students and teachers). Some are face-to-face and others are on-line.

**Strengths:**

- The STEAM forum is promoted.
- The role of women is promoted.
- Young people emerge with real business experiences.
- Innovative methodologies are used.
- New spaces are worked on.

# MEETING OF PEERS



**Organisation:** Elhuyar.

**Original name of the project:**

Parekoen topaketa, Zientzia Azokaren testuinguruan.

**Duration of the meetings:** 1 hour plus the necessary hours of preparation.

**Place:** STEM professional work centres.

**Description:**

Students work on scientific or technological projects throughout the academic year for the Elhuyar Zientzia Azoka initiative. In addition, at the Peer Encounter they receive advice from university researchers and other STEM professionals, as well as advice from young people.

The participants will have to present their projects to the audience in a 3-minute explanation.

Subsequently, the group of young people or STEM professional, gives the presenter a "flower" and a "new idea" for the project presented. Then the roles are swapped, as the pairs change, and the process is repeated 5-6 times. In the end, both young people and STEM professionals will have received 5-6 "new ideas" and "flowers" for their projects.

**Strengths:**

- Young people and professionals become more confident about their projects.
- They work on communication skills, creativity and improvisation.
- Knowledge is shared. Young people receive ideas.
- Actions are carried out in local places.
- Researchers are also inspired.
- It is also positive and motivating for teachers.

# RESEARCH CENTRE



**Organisation:** CFM (Centro de Física de Materiales - Materials Physics Center) and Donostia International Physics Center (DIPC).

**Original name of the project:** School visits.

**Duration of the meetings:** 2 hours.

**Venue:** the CFM and the DIPC.

## Description:

The Materials Physics Center (CFM, CSIC-UPV/EHU) and the Donostia International Physics Center (DIPC) organise annual visits to schools in Gipuzkoa. Fourteen visits are programmed and receive around 500 students.

## Programme:

**9:30-10:00.** Presentation: research centre, nanoscience and scientific careers.

**10:00-11:00.** Visit to three laboratories.

Researchers describe the work of the laboratories and show how to use the tools and equipment.

- 1) DIPC Computing Center.
- 2) Nanophysics and Nanoscience Laboratory (CFM).
- 3) Polymer chemistry laboratory (CFM).

**11:00-11:30.** Lunch in the CFM cafeteria.

## Strengths:

- Getting to know the technical and personal bases of the best research centres worldwide.
- Making cultural diversity visible and showing that current science is based on collaboration between experts from all over the world.
- Breaking racial, gender and linguistic stereotypes.
- Making women visible, although right now the gender proportion is not balanced.
- It is a unique experience for young people.

# LOOKING FOR A REGIONAL PLAN



**Organisation:** Debegesa

**Original project name:**

STEM Vocations in the Lower Deba.

**Duration of the meetings:** one academic year (2018-2019).

**Venue:** Lower Deba.

**Description:**

The strategy and the regional action plan to promote technical and scientific vocations among young people, especially among girls, are specified among all the players.

Special attention is paid to immigrants within STEM's social integration tool.

Organization of events in municipalities and counties: Robotics, Science Week...

Neighbours have been created.

**Objectives:**

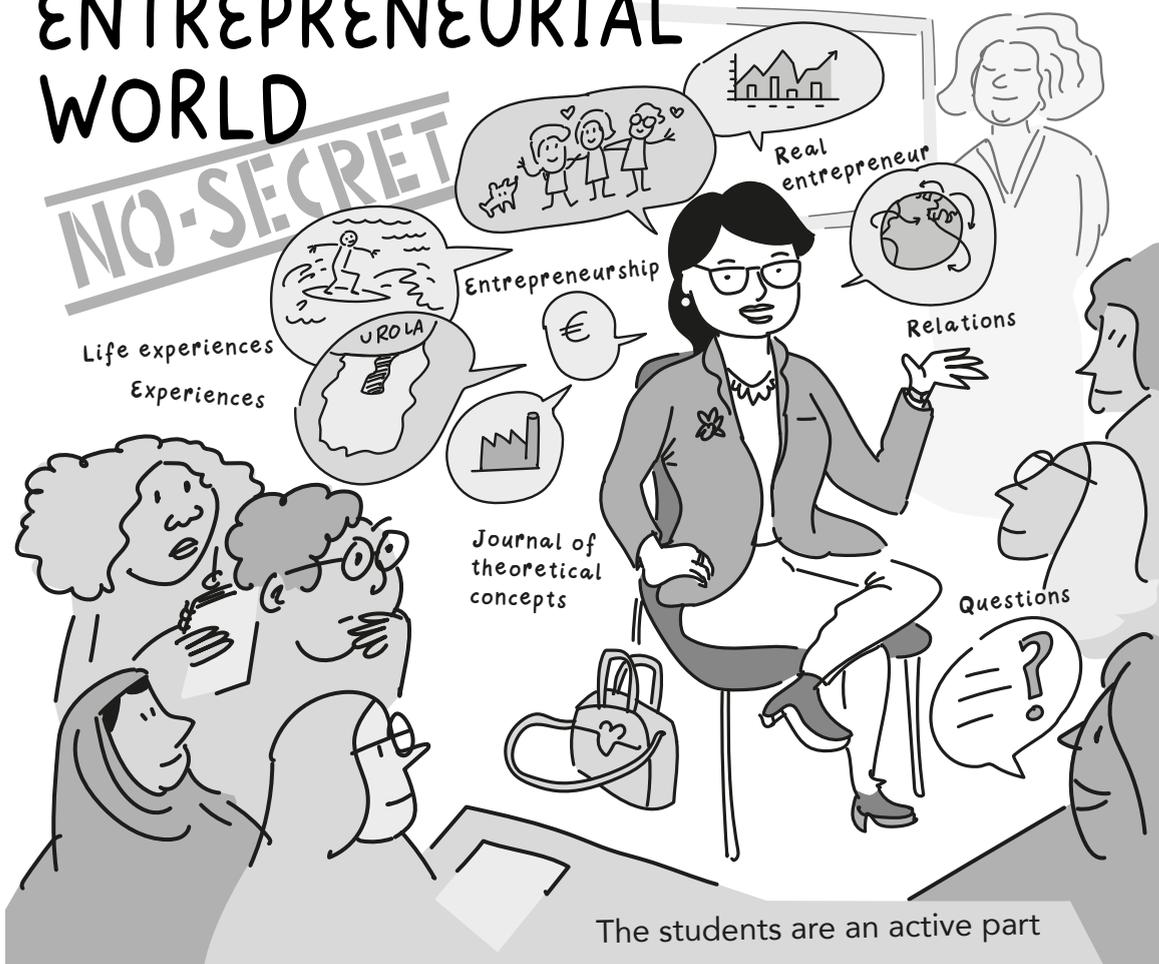
- To complete the map of players.
- To promote forums: town councils, schools, STEM women, companies, families...
- Collaboration and promotion of working groups.

**Strengths:**

- The setting up of a general forum.
- Getting the support and involvement of companies.
- Creation of a forum of agencies around STEM.

# ENTREPRENEURIAL WORLD

NO-SECRET



**Organisation:** Iraurgi Berritzen.

**Original project name:**

Izan Ekintzaile.

**Duration of the meetings:** sessions of about one hour.

**Location:** schools.

## **Description:**

The aim is for students to get to know the experiences of entrepreneurs and to promote the necessary skills. To this end, entrepreneurs are invited directly to the schools so that the students can listen to their testimonies. In addition, this project aims to highlight entrepreneurial activity in the region.

## **Strengths:**

- Students have the opportunity to get to know the real entrepreneurs in the area.
- Students can ask the entrepreneurs directly about matters of interest.

# With the GRANDPARENTS to the UNI

TWO SESSIONS:

AT SCHOOL

AT UNIVERSITY



**Organisation:** Passionate researchers  
**Original name of the project:** With the grandparents to the University.  
**Duration of the meetings:** 4 hours (2 sessions of 2 hours).  
**Venue:** school, university.

**Description:** Secondary school students go to the university with their grandparents. A session to share mutual knowledge is organized in advance at school to transform the image of the scientists and to explain what they need when they go to university to carry out experiments.

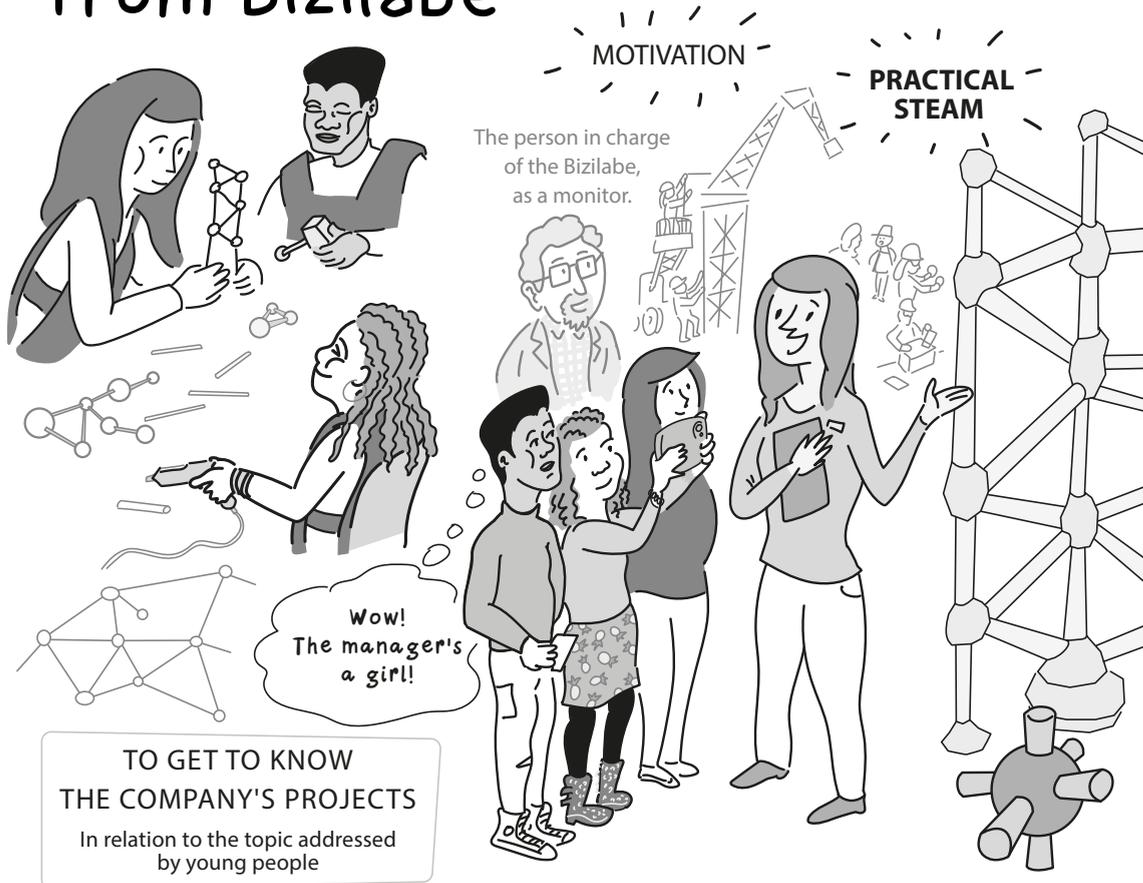
The details of the initiative are explained to the grandparents in advance so that they can relax when they go to the university.

In the second session, the students go to the university with their grandparents to carry out a series of experiments: pigment chromatography, observation of stomata under the microscope, dyeing, and so on.

Grandparents participate to get the young students interested, and form laboratory pairs with them.

- Strengths:**
- Knowledge of real laboratories.
  - Possibility of changing roles.
  - Letting the young people learn by explaining.
  - Strengthening of family relationships.

# BUSINESS TASTINGS from Bizilabe



**Organisation:** Elhuyar-Bizilabe.

**Duration of the meetings:** two-hour visits.

**Venue:** local companies.

**Description:**

In the final session of a STEAM workshop led by professionals, the young people will visit a real company related to what they have received.

Besides meeting the employees at a local company or association, the young people will get know the projects in which these professionals work.

In addition, they can share what was done in the workshop with the company's professionals.

**Strengths:**

- Offering young people an "adventure" outside school.
- That young people feel "privileged".
- Possibility of getting to know real companies in a very close environment (km 0).
- Generating the "other world" effect.
- Expanding the possibility of developing the contents worked on.
- Enabling diverse experiences.
- Providing young people with the opportunity of working in heterogeneous groups.

# I have a QUESTION FOR YOU...



At the meeting, from all the questions, the ones to be asked to the invited persons are chosen by drawing lots.

## INSPIRATION

They're people too!



At lunch, you can talk more quietly with these leading scientists.

You can even take out your selfies!



### Organisation:

Donostia International Physics Center (DIPC)

**Original name of the project:** Top@ DIPC.

**Duration of the meetings:** one month prior to the meeting to prepare the questions before the actual meeting.

### Description:

Every year a meeting involving over 300 people is held between leading researchers and secondary school students. At the event, after the presentation of the scientists, the students have the opportunity to ask them about their lives, research and scientific careers, and see that these great scientists are normal people.

Students prepare questions in advance at the centre. During the event, the questions are selected by drawing lots. At lunch time, students have the opportunity to talk in a more relaxed way with the scientists. The aim of the meeting is to “inspire” scientific vocations and promote scientific culture.

### Strengths:

- Preparation of topics in advance at school.
- Designation of representatives by the schools (3 or 4 students per school).
- Chance to get to know world-class professionals (take selfies, etc.).
- The commitment of these great scientists to STEAM education. The young people are included as part of a wide audience.
- Detailed and general questions.
- It is positive for scientists, too.
- Setting an example for Europe.

# 8 Recommendations for STEM professionals when meeting young people

The recommendations we would make to organisations with STEM professionals when contacting young people.

## GOOD PRACTICES

- Give the participants (researchers, professors...) specific guidelines.
- Design experiments and actions that require few resources.
- Assume the role of advisers.
- Take into account the reality of and usefulness for each school.
- Flexibility and openness of designs.

## AGE

It is recommended that children in Pre-primary and Primary Education be integrated from the age of 3, although most of the participants will be between 10 and 14; adult activities can also be designed.

## PERSONAL

It is important to value professionals as role models, acknowledge their authority and not fall into the trap of gender stereotypes in terms of attitudes and behaviours. For example, do not allow the strength of a woman who is in contact with young people to be undermined or for her to be superseded. We are creating models and without realizing it we may repeat some of the causes that lead to the situation we are intending to change.

## NETWORKS

It is essential to create networks and alliances with teachers, schools, companies and environmental agents. It is very interesting to document them, analyse what has been done in other places and adapt them to each case, as well as "sell" STEAM activities well.

## GENDER

Working on gender diversity, exceeding standards and ensuring gender equality are ongoing tasks. We are interested in promoting women's visibility, identifying them, involving them, etc.

## AIMS

Science! Embrace the world! It is important to foster positive emotions around science and its values: teamwork, common goals and diversity of projects as enriching.

# 8.1 Recommendations for teachers

Come on! Teachers, get involved in projects, feel part of the actions!

## GOOD PRACTICES

It is advisable for teachers to participate actively both on a visit and in a meeting between STEM professionals and young people, and not to assume the role of childminder. In some cases taking a back seat may be recommended. At other times, it is advisable not to participate; “disappearing” from some activities may benefit the objectives pursued with young people.

It may be appropriate to:

- Speak 5 minutes in advance with the organisation: What is to be done? What role will the teaching staff play? etc.
- Prepare the session/activity, give it the importance it deserves.
- Encourage the participation of students of immigrant origin.
- Etc.

## OVERCOMING ROLES:

SOCIOECONOMIC ONES, STEREOTYPES, FEARS.

- Pay attention to the roles played by young people!
- Regard science as a transversal part of our culture, do not be afraid of it.
- Science is not exclusively for the best students.
- Scientific culture can act as a social ladder.

## GET AHEAD:

**“get out of your comfort zone”.**

- Judge the initiatives honestly.
- Encourage personalised participation.
- Open the way to the creativity of girls. Don't rush into things, be attentive when the needs of the children arise.
- It can turn young people into the protagonists in the design of projects.
- Collaborate with students in the development of processes.
- Foster the confidence and safety of children and young people.

## Related to the PROCESS:

- Focus first on the process and then on the results and responses.
- Reward the attempt.
- Previous preparation of contents, where, with whom, for what, why... To arouse curiosity, ask questions and take into account ALL the interests of young people (including personal interests).
- In the meantime, actively involve, collaborate, be an example, show curiosity.
- Then do the assessment with the students and share it with the school/ teachers.

## AND AFTER THE EVENTS

- Talk about what was seen/reflected when students return to school.

## 8.2 Recommendations for researchers

### BE YOURSELF

Great attention and interest are attached to professionals, by way of example, and there are many recommendations for showing what their normal daily lives are like:

- Change the stereotyped image of the researchers: they may be bad students, they engage in normal leisure pursuits, they are generally “normal”.
- Transmit real experiences and personal life.
- They want to know you as you are.
- Be natural, do not invent anything in order to look better.

### GOOD PRACTICES

Some recommendations to ensure the success of the events:

- Put yourself in the shoes of the young people, listen and ask, allow them to be the protagonists. Try to get close to them figuratively speaking.
- Approach schools and students on the basis of experience.
- Adaptation to general language.
- Reinforce the process itself rather than the result (as happens in science).

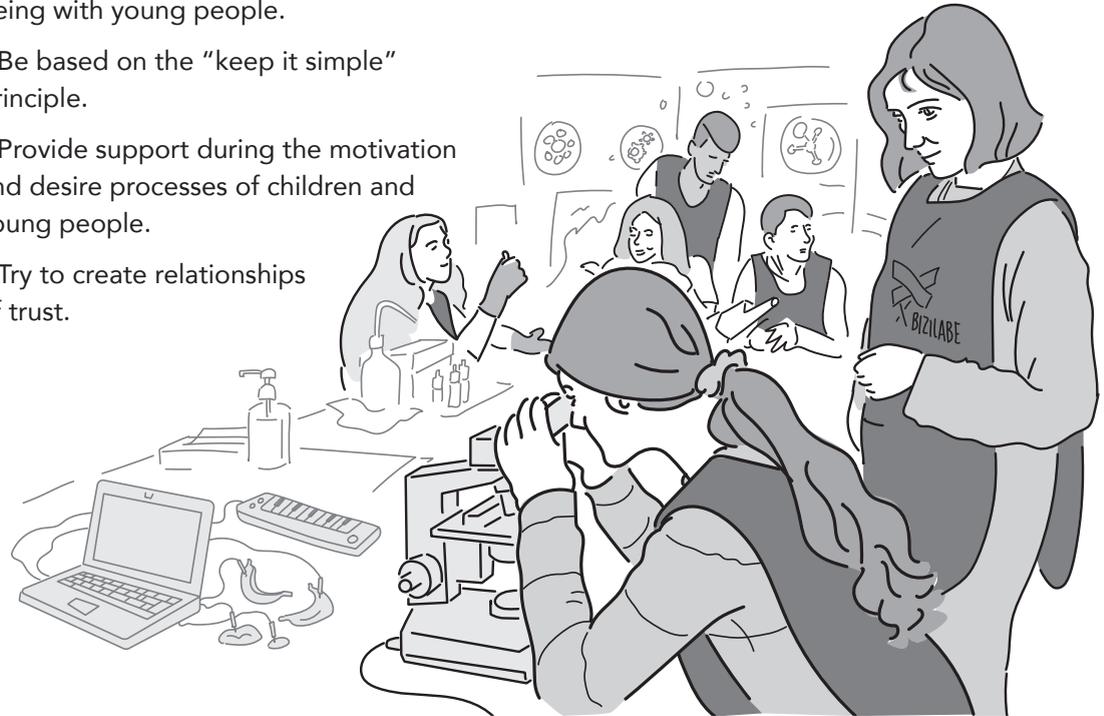
### SPREAD THE STEAM ATTITUDE

In this general strategy, professionals can add some touches, such as:

- Fleeing from “excellence” to reality.
- Attaching importance to the fact that detailed research is important but without forgetting the general objectives when being with young people.
- Be based on the “keep it simple” principle.
- Provide support during the motivation and desire processes of children and young people.
- Try to create relationships of trust.

### GIRLS, BOYS, IMMIGRANTS

- Girls need role models.
- Watch out for the boys’ prominence!
- Attract students from immigrant backgrounds.



This brochure is the result of the collaboration of many people and we would like to thank everyone who has participated.





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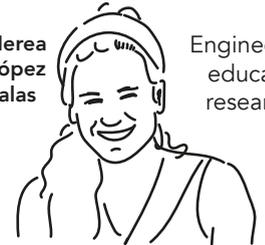


Decide what to do  
for yourself!

**WE'RE SCIENTISTS.  
AND YOU, WHY NOT?**

**Nerea López Salas**

Engineer and  
education  
researcher



**Ainhoa Iñiguez Goizueta**  
Mathematics

**Maddi Ibarbia Garate**  
Biomedical Engineer



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