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EDICIONES COMPLUTENSE

Inspira STEAM: breaking the confidence gap with female roles

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Abstract. Following women's careers in STEAM can be compared to a leaking pipeline, which leaks in so many ways that, in the end, it is empty before it reaches leading professional positions. However, even before, girls do not opt for STEAM studies, and one of the main reasons is their lack of confidence: both their self-confidence and other people's confidence in them. Girls see the potential of women in many fields, but when asked directly, they do not see themselves as able to be good scientists or technologists. This lack of confidence is what we found in the Inspira STEAM project, aimed at increasing the interest in STEAM of girls in primary education and promoting scientific and technological careers. The project consisted of six one-hour sessions following group mentoring methodology at school-hours carried out by female professionals in STEAM as close reference models. Mentors were trained in the methodology, gender perspective and materials developed for the sessions. After completing the program girls, boys and mentors completed a questionnaire about their experience. Results show great satisfaction of participants with the program but less self-confidence in the performance of mentors. Also, girls show high confidence in what women are able to achieve, but not so much in what they, personally, can achieve related to science and technology. These results have great relevance to understanding the confidence gap and figuring out how to close it.
Keywords: technical professions; science; digital gap; professions; girls; sorority; gender; confidence.

[es] Inspira STEAM: rompiendo la brecha de confianza con roles femeninos

Resumen. Seguir una carrera STEAM para las mujeres puede compararse con una tubería con fugas, que se filtra de tantas maneras que, al final, se vacía antes de llegar a posiciones profesionales de liderazgo. Sin embargo, incluso antes, las niñas no optan por los estudios STEAM, y una de las principales razones es su falta de confianza: tanto la confianza en sí mismas como la confianza de otras personas en ellas. Las niñas ven el potencial de las mujeres en muchos campos, pero cuando se les pregunta directamente, no se ven capaces de ser buenas científicas o tecnólogas. Esta falta de confianza es lo que encontramos en el proyecto Inspira STEAM, cuyo objetivo es aumentar el interés de las chicas por las STEAM en educación primaria, a través de seis sesiones de una hora de duración en horario lectivo y promover las carreras científicas y tecnológicas a través de la mentoría en grupo llevada a cabo por mujeres profesionales STEAM como modelos de referencia. Las mentoras reciben una formación sobre la metodología, la perspectiva de género y los materiales desarrollados para las sesiones. Después de completer el programa, las chicas, chicos y mentoras completan un cuestionario sobre su experiencia. Los resultados muestran una gran satisfacción de los/las participantes en el programa, pero una menor confianza de las mentoras en su desempeño. También, las chicas muestran una gran confianza en lo que las mujeres pueden alcanzar, pero no tanta en lo que ellas, personalmente, pueden lograr en relación a la ciencia y la tecnología. Estos resultados no podrían ser más relevantes para entender la brecha de confianza y averiguar cómo cerrarla.
Palabras clave: profesiones técnicas; ciencia; brecha digital; profesiones; chicas; sororidad; género; confianza.

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1. Introduction

Usually, when we talk about the lack of female presence in science and technology, we illustrate it with the metaphor of a pipe with many holes through which girls, young women and women drip, until, on reaching the professional stage, they have disappeared almost entirely (Clark Blickenstaff, 2005). One of those holes that are present in all life stages is female confidence. According to (Robnett, 2016), social identities and self-concepts can shape young people's STEM career choices. Understanding the multiple factors related to confidence provides information about existing gaps in the performance of high school students in STEM courses.

This confidence and self-concept, in the case of girls, is degraded at very early ages. In one study, children were asked whether, when told about a particularly intelligent person, they believed he or she was their gender or the other (Bian et al., 2017). We observed no differences when they were five years old: boys chose men and girls chose women 75% of the time. However, from the age of six, while boys still chose men as 'very, very clever' 65% of the time, girls only selected their own gender 48% of the time. These results fit in with earlier research (Kessels, 2015) that found that families and teachers tend to attribute good grades in school to girls' effort, but boys' natural ability. These results are in line with the stereotypes associated with STEM careers in which people associate degrees in these areas with brilliance and innate talent rather than with effort (Leslie et al., 2015).

According to data from the OECD's 2015 International Programme for Student Assessment (PISA) report (INEE, 2015), girls believe they are less able than boys to achieve goals that require scientific skills, what is called Self-efficacy in Science, which is confidence in one's ability to achieve the desired results (Bandura, 1997). According to the OECD, female students, even those who perform better academically, tend to have a higher feeling of anxiety about mathematics. This anxiety if so pronounced that one study (Régner et al., 2016) showed that girls performed better on a math test identified as "Drawing" compared to the same test identified as "Geometry."

To this, we add the Pygmalion effect or self-fulfilling prophecy. This effect refers to the fact that expectations about a person's performance incite that person to act according to those expectations (Rosenthal & Jacobson, 1968). Rosenthal and Jacobson found that teachers' high expectations of their students positively increased their cognitive ability. The researchers later found that students' gender, past performance, race, or ethnicity influence teacher's expectations (Ferguson, 1998; Howard et al., 2015). In other words, the expectations of teachers, family members, and society in general, have an impact on girls' performance. Thus, if a teacher thinks that a girl will get excellent grades, this can raise her self-esteem and encourage her to work to achieve the results expected of her. However, the same thing happens in the opposite direction: the negative Pygmalion effect, also known as the Golem effect (Dresel et al., 2007), which causes self-esteem to decline. If society repeats that girls are not going to do well in mathematics, there is a resulting negative self-expectation. In addition, while peer support may be relevant for overall academic motivation (Stake, 2006), it may be especially important for girls in relatively non-traditional areas such as mathematics and science (Crosnoe et al., 2008).

Female students also have significantly less confidence in their computer skills than men (Beyer et al., 2003), making this one of the main barriers to their entry and advancement in STEM disciplines. According to Fisher and Margolis (2002), this low confidence is not caused by academic performance but by unfavourable comparisons with other students in light of the dominant image of what constitutes success. Analysing the background characteristics, career aspirations, and self-perceptions of female first-year college students in the United States who intend to major in computer science (CS), results show that they rate themselves higher than men in CS, but lower on academic and leadership ability (Lehman, Sax and Zimmerman, 2017).

According to Beyer et al. (2003), women develop this interest at a later stage than men do, since boys have been experimenting with computers from a very young age. On average, women enter university computer courses with less previous experience in programming, generating more anxiety and less confidence in their computer skills.

At the university, things do not change. A 2003 study analysed the impact of women's perception on their capacity (Ehrlinger & Dunning, 2003). The study gave male and female students a questionnaire on scientific reasoning. Before the test, women rated themselves more negatively than men in terms of their scientific ability: on a scale of 1 to 10, women averaged 6.5 and men 7.6. When it came to evaluating how they had answered the questions, women thought they had matched 5.8 out of 10 items; men, 7.1. Their average was almost the same: women got 7.5 out of 10 and men 7.9. In other words, the female students underestimated their performance because they also underestimated their scientific reasoning capacity. On the other hand, women do not receive the same level of support as men to enter and remain in careers such as computer engineering from family, friends and classmates (Cohoon, 2002).

Even the reasons for not approaching technology are different, and the confidence component directly affects women. In a study carried out by Tech City UK in the United Kingdom, while men ruled out working in

technology "because there are other more interesting areas" (50%), women did so because: "I do not have the skills to work in Technology" (45%), "lack of knowledge about Technology" (38%), or "it's not for people like me" (24%) (Tech Nation Talent, 2018).

In the professional stage, the confidence gap persists, not only because of the impostor syndrome (Simmons, 2016). An internal analysis by the technology company Hewlett-Packard showed that women applied for internal promotion only when they believed they met 100% of the conditions listed for the position. However, men applied with only 60% of the requirements met (Clark, 2014). When it comes to salaries, the same thing happens. According to Babcock et al., 2003, men negotiate four times more than women, and when they do, they ask for 30% less.

These studies show that the confidence of girls and women is critical when it comes to choosing and pursuing studies and professional development in STEM areas, and maintaining it. The Inspira STEAM program was born in 2016 for the promotion of scientific and technological vocations of girls, through the improvement of the confidence and self-concept of girls. Through questionnaires, observation and focus groups, we want to analyse the degree of trust and self-concept of the girls and mentors participating as a determining factor of their interest in STEM areas.

2. Inspira STEAM, promotion of scientific-technological vocations among girls

Inspira STEAM was created to plug the confidence hole in the pipe, and to address the lack of role models available to most girls. Inspira STEAM is a pioneering project for the promotion of scientific-technological vocations among girls, based on awareness and orientation actions, taught by professional women from the research, science and technology world. It is the first time that the group mentoring technique is used in a project to promote STEAM (Science, Technology, Engineering, Arts and Maths) among elementary students. We selected this methodology because of the link established between mentors and girls during six sessions during school hours, helping the latter to have a mirror in which to look at themselves and making possible the space of trust necessary for them to clear all their doubts.

The reason for our action is girls in sixth grade or, in some cases, the first year of secondary school. We want them to become aware, to reflect and share their concerns about STEAM and the barriers they encounter in accessing related studies. We also work with boys, because it is essential that they are aware of the differences, due to gender, in the field of science and technology and, in some cases, the barriers they encounter are the same as the girls (e.g. misunderstanding STEAM professions, their presence and relevance in our lives, and so on).

The heart of our project is the mentors who, voluntarily, bring their day-to-day life to girls and boys through six work sessions during school hours. All of them are scientists and technologists who develop their activity in different fields: academic, business, research, management, and so on. During the work sessions, mentors and students address topics such as stereotypes that surround us, STEAM professions or women and science throughout history. With these meetings between mentors and girls, we want to help to dispel doubts and objections about occupations in science and technology, clarify their motivations and strengthen their self-esteem to start this professional path, if they wish.

The key objectives of the project are:

- We want to facilitate new references of women technologists nearby.
- That boys and girls discover STEAM professions.
- Raise awareness of the need for the country's development to occur between men and women.
- Raise awareness and guiding of technology careers.
- Make visible and value women technologists.
- Inform about existing stereotypes so that they do not condition the choice of studies.

2.1. An innovative proposal

Inspira STEAM started in 2016 at the Faculty of Engineering of the University of Deusto, merging the work of the Deusto LearningLab research group, which works in the teaching-learning of STEAM in primary and secondary, and the concern of the Faculty about technological vocations, especially among girls. Awareness of the reality in different types of study (university, high school, vocational training) and having studied the causes that literature cites concerning the lack of female vocations in science and technology, we made the following design decisions to address these causes and design Inspira STEAM: focus on sixth grade, separate girls and boys during some work sessions, develop six sessions during school hours, train the mentors, develop quality material and adopt the methodology of group mentoring. The decisions that mark the main innovative aspects of Inspira STEAM compared to other initiatives explained below.

Develop six sessions during school hours

Unlike other initiatives, Inspira STEAM does not consist of a single activity where a female scientist or technologist shares her experience with children, but over six sessions it facilitates a space for reflection and awareness, where girls can share their doubts and concerns about STEAM areas, studies and professions. It is also essential to integrate activities during school hours and not in extracurricular activities, to which many families do not have access due to various circumstances. Thanks to the involvement of the schools, we ensure that Inspira STEAM reaches all schoolchildren of the course equally. The development of six sessions, with a space between them of one or two weeks, allows generating a climate of confidence and security challenging to create in a single day. It will enable girls to open up, express themselves more freely, confidently and safely and ask questions that they would not otherwise do.

Focus on sixth grade

There are many initiatives to promote the interest of young people towards science and technology oriented to secondary and high school (Inspiring Girls, She++, Technovation Girls, etc.), which is when students must choose their vocation and subject for higher study. However, several studies have shown that young people's professions, preferences and interests manifest themselves at these ages, but that influences occur earlier (Bian et al., 2017). Critical periods are between 11 and 13, in terms of what they like and stop liking and for what they feel they are capable of doing or not. We observe that girls, in particular, perform better in mathematics or science, but they perceive, influenced by their environment, that engineering, physics or mathematics "are not for them", so they often choose to develop other subjects (Dar-Nimrod and Heine, 2006). Therefore, we consider that 6th grade, just before the change to secondary school in Spain, is the best age to intervene.

On the other hand, the transition from primary to secondary school coincides with a change in girls' self-perception, a stage in which insecurities, fears and changes in self-esteem appear. It is another reason why the transition from primary to secondary school is an excellent time to carry out the Inspira STEAM program.

Participating mentors

Women with professional experience in STEAM areas can participate voluntarily as mentors in the program. Most of them have studied related areas even if it is not an exclusion criterion, for example, some women have studied law or marketing but work in industrial or highly technological companies, so we consider them suitable STEAM role-models for students.

The first time they participate in Inspira STEAM, women have to attend an 8-hour training session to familiarize themselves with the mentoring methodology, objectives of the project and materials developed to carry out the mentoring with girls and boys. Also, since they work with under-aged students, every year they have to provide the sex crime certificate.

According to their preferences (location and language), they are assigned to a group of students with whom they will work during six 1-hour sessions. We also ask them to answer a questionnaire after the last session to get their feedback related to several aspects of the program.

Participating schools

Any school from the Basque Country can participate in the program; there are no entry conditions or fees. The only cost for schools is the Workbook they have to provide to each girl and boy. The localisation of the school and the language in which they want the students to receive the sessions (Basque, Spanish or English) are the only barriers to find mentors who can work in each school. The order of registering is the last criteria to select a participating school.

Considering this, Inspira STEAM includes schools from any region and type in the Basque Country, although they concentrate in the three capitals of the three provinces: Bilbao, San Sebastian and Vitoria. One of the future challenges is to reach more rural areas and small schools far from the big urban areas.

Separate girls and boys in some sessions

We know that there is currently a lack of general interest among youth when it comes to science and technology in studies and professions, which affects both boys and girls. Many reasons that make young people not interested in these areas are lack of awareness of engineering or scientific professions and what they entai; the wrong perception of their difficulty; lack of knowledge of the range of professional development possibilities of these degrees; the low social relevance that is given to science and technology in many contexts.

However, other issues reach girls and boys very differently. Stereotypes of science and technology professions have a lot of gender bias. Public references regarding professionals who receive recognition are affected

by a society that is still far from being gender-neutral. It is still common today to hear that women do not like technology, that there are no good women scientists, that the most renowned technologists are men; and stereotypes like the solitary scientist, the asocial computer scientist or the incomprehensible technologist. With the same academic performance in science, a girl's self-perception of her potential and her viability to pursue a career in science is inferior to boys. Despite relatively equal achievements in science education, girls tend not to identify with science, a problem that grows as girls progress along their potential scientific trajectory (Barton, Tan, & Rivet, 2008).

The Inspira STEAM project proposes a specific activity of introspection and reflection of girls with girls, and boys with boys, after which there is always the intention of later sharing the conclusions in the joint group. That girls face the variety of causes and barriers that make it difficult for women to develop their potential in science and technology is especially valuable, and we have contrasted that the environment created in small groups is very trustful and highly enriching. During four sessions, the girls engage in different activities with a female STEAM professional, which is the mentor (i.e. discussion, role-playing, display videos and reflection, quizzes, experiments, etc.). By helping girls to share this time with a STEAM role-model we fight one of the great causes of the problem of gender bias in science and technology: the lack of female references. Small groups of girls and small group of boys generate valuable dynamics that can then be shared and transmitted in the large group. In our experience, it is not useful to isolate children in a fantasy in which society does not discriminate by gender. It is helpful to recognise the real situation and to become aware of it to transform it.

After working with hundreds of girls and collecting their feedback, the Inspira STEAM project has validated the opportunity to carry out the mentoring process in this way. The girls take advantage and enjoy the shared space "of girls", it helps them feel like they are protagonists, exploring an area of freedom and self-discovery, and they develop different dynamics to those that would occur if boys also participated. Inspira STEAM boys, in turn, have an opportunity to discover this gender difference, ask questions about the advantages and disparities that society has established, and also generate an enriching reflection space for them.

It is also essential to ensure that the working groups are much smaller than a standard class (we prefer groups lower than 15 and preferably closer to 10). The process carried out and facilitated by the mentor provokes everyone's reflection, expression and participation and seeks to make each girl aware of her importance and her ability. In turn, after this work in small groups, the return to the large group generates beneficial dynamics and better cohesion in the groups.

The Inspira STEAM project separates to integrate and differences that individuals need to understand in order to comprehend the role of gender bias in the real world. Improvement is more viable from the awareness of reality.

In addition to the reasons mentioned above, we believe that Inspira STEAM proposes an opportunity to generate the first experience of sorority among girls, in line with relevant social movements today in our society. It promotes positive relationships and alliances with other girls to contribute with specific actions to the visualisation of all forms of machismo and gender marginalisation, and to provide mutual support to facilitate the vital empowerment of each girl.

Train mentors, nearby references

One of the keys of Inspira STEAM is to have female role models in science and technology. The selected mentors are women in their environment who develop relevant jobs and projects, passionate about their work, who make a significant contribution to their organisations and society and, at the same time, have vibrant and attractive lives.

We consider it essential that mentors receive adequate training to work with the girls and boys. The aim of Inspira STEAM is not to give a talk or workshop, but to create a space for reflection, awareness and debate where girls and boys can address the barriers that make their access to STEAM studies more difficult. That is why we prepare the mentors, who do not necessarily have to be familiar with the age of the children or with facilitating these type of spaces, through two sessions of 4 hours each, where we address the mentoring methodology, the gender perspective of the project and the materials developed.

Develop quality material for mentors

In addition to the training, we have developed some tools to take Inspira STEAM into the classroom. The first important tool is a script for each session that the mentor uses to work with the girls, which describes the objectives, justification and activities to perform in the classroom. The mentors have audiovisual contents and other resources that they can incorporate into the sessions. In addition, we have designed a Workbook for the girls and boys who participate in Inspira STEAM, where they can carry out some of the activities and also have resources that they can complement outside the classroom. The notebook is also an excuse to familiarise their families and friends with the project so that they can talk and share the Inspira STEAM project with them.

Adopt the group mentoring methodology

Among the very varied methods that we could have chosen with Inspira STEAM, we considered that mentoring is the best model to achieve the proposed objectives. In this process, the girls are the protagonists, and that is what we focus on with the mentors in their training: as a mentor, I encourage the girls to participate, I create the appropriate climate for participation, I adapt to each specific group, I encourage them to express their ideas, I learn from what they say, I don't interrupt them when they speak, I don't tell them my "story" all the time, I'm willing to let myself be surprised, and so on. And they are guided on the type of facilitation that they have to carry out in this space through the Ideario STEAM Inspira Ideario for mentoring:

- The girls and their reflection process are the protagonists of the mentoring process.
- I listen and communicate with quality, ask questions and act from serenity and humility.
- It is up to me to provide a safe space, where all children can participate, learn, reflect and leave their comfort zone.
- The contributions and opinions of all girls are valuable.
- Girls can address their reflection processes. I listen, recognise and value those processes.
- When girls freely reach their conclusions, their opinions will be more profound and lasting.
- This process is for the "empowerment" of girls.
- The group reflection is enriching, both for girls and for me.
- I am not looking for short-term results. This project is a seed sown in each girl for the future.
- I put my achievements, my resources and my skills at the service of the girls and their process.

3. Methodology

3.1. Participants

One hundred fifty-nine women participated as mentors in the 2018-2019 (3rd) edition in the Basque Country. Of these, 71 responded to the satisfaction questionnaire, with an average age of 42.13 years (TD=7.76). More than 100 attended one of the three closing days held in Bilbao, San Sebastián and Vitoria. In that same edition, 2,078 girls and 2,062 boys from 81 schools participated, of which 1,761 responded to the questionnaire, and 50% were girls. The average age of the students is 11.3 years old (SD=0.70).

Eighty schools participated in the 3rd edition in the Basque Country. Fifty-five percent were public schools, 5% private and 40% semi-private. Sixty percent are in the cities of Bilbao, San Sebastian and Vitoria, the rest in smaller towns in the territory. As mentioned before, no entry requirements or fees are asked to schools, only to provide a Workbook to every student in the program.

3.2. Materials and Tools

Materials developed to implement the Inspira STEAM program in the classroom

We developed a mentoring script for each of the six sessions, a Workbook with activities and resources for the girls and boys.

The *Scripts* describe the objectives of the session and the different dynamics that can be carried out. The material includes additional resources, such as links to videos and articles. It is an open resources that each mentor can adapt and modify according to her preferences and those of the group. In this edition, we paid attention to how to use the materials with the boys, what things affect girls and boys equally, and what needs to be approached differently based on initial experiences.

We designed the *Workbook* for girls and boys so students can carry out classroom activities with the mentor, access linked resources beyond the sessions, and share what they have discussed with family and friends.

Inspira STEAM community

Once mentors begin their work in the classroom, they communicate through the community that we put at their disposal. Here, they can share their experiences, the resources used, other resources invented, and also the difficulties encountered or any information they want to share with the other mentors. Mentors who participate in the project at the same schools or have another type of relationship also create their own WhatsApp groups to communicate and coordinate.

Throughout these editions, the resources shared by the mentors, schools and the project team have been collected, as well as others designed by them, which have become part of a set of complementary resources that are made available to the Inspira STEAM community.

Mentor Satisfaction Questionnaire

At the end of the Inspira STEAM sessions, the mentors were asked to complete a satisfaction questionnaire. This questionnaire consists of 13 questions, with closed responses on a scale of 1 to 10 (1=very bad and 10=very good), focusing on the Motivation of mentors to participate in the programme and the Process Rating. Five other questions were posed to know the mentor's degree of fulfilment of the objectives, on a Likert scale of 5 values (1=no agreement and 5=totally agree).

Some of the questions are: "I feel that I have fulfilled the objectives set for us by the INSPIRA Project"; "The suitability of the material and contents worked on in the classrooms with the children" and "Do you think that at a general level, those motivations that decided for you to participate in INSPIRA have been fulfilled?".

Satisfaction questionnaire for girls and boys

Like the mentors, at the end of their participation in the programme, the students were asked to answer a satisfaction questionnaire. This questionnaire is made up of 7 Likert type closed-response questions with five values (1=nothing and 5=much), a question about the participation of girls and boys and four other open-response questions to evaluate the best and worst of the programme.

Some of the questions are: "I think I could be a very good scientist or technologist", "I think other girls must participate in Inspira STEAM" and " I would like to continue learning about science and technology".

Closing days –observation space 1

Once the programme completed, we held a closing day in each of the Basque capitals. The day lasted 4 hours and took place in three stages, the first of which was an internal meeting with mentors and people from the schools to reflect on their experience in the programme, and on the resources they had used and generated. They were also asked to leave testimonies in the form of letters, videos or other supports. This meeting allowed us to gather qualitative information about how the mentors had felt, expectations, emotions, etc.

Training for mentors –observation space 2

Although we did not plan to collect information for the study during the training of mentors, the security and trust created led the mentors to express their emotions, expectations, fears and concerns in a very open way. This qualitative information gathered from their testimonies has been incorporated into the study.

3.2. Procedure

A. Preparing the experience

The implementation of Inspira STEAM begins with the search for mentors and schools that want to participate in the program. This search is carried out through the means at our disposal (RRSS, distribution lists, web, etc.) and, most tellingly, word of mouth among all the people who have participated in the project, or that at some point have shown interest and who, by sharing their experience, involve other people.

The mentors are STEAM women who voluntarily participate in the free training offered to them and work with the girls or boys in the classroom. They are women with STEAM studies or who develop their professional work in the STEAM sector. Although there are some postgraduate or doctoral students, preferably the mentors have more or less extensive professional experience. The profile of the women is rich and varied, which is an excellent value for the project.

Any school in the region can participate in Inspira STEAM for free. Schools are asked to provide a Workbook to each girl and boy who participates in the program. Schools also have to request the consent of the families of the participating children. In case there are not enough mentors to work with the group of boys, someone from the school is asked to work with them, but they must first attend the training offered by the program.

Mentors receive the training described above and are asked to provide some information to complete the assignment, such as the geographical area where they prefer to conduct the sessions; the language in which they can do it (e.g. Spanish, Basque, Catalan, Galician, English); the number of groups they would like to mentor (up to. 3); whether they are going to work with girls, with boys or either.

The schools are asked the language in which they want to do the program, the number of groups that will participate and the number of girls and boys per group, and the contact person for all coordination with the mentor and with us.

With the mentors who have completed the training and handed in the certified criminal background check, and with the schools that have completed all the data, we make the preliminary assignment, and the mentors are notified to give their approval or suggest changes. This process is iterative until all the mentors are in a school, and all the schools have mentors, at least for the girl groups. Once approved by all the mentors, the mentors are put in contact with their corresponding schools so that they get to know each other and begin to coordinate all the necessary actions.

Ethical and privacy issues

Inspira STEAM is aware of the ethical aspects related to its implementation with minors. Therefore, it has the approval of the Ethics Committee of the University of Deusto, requests the informed consent of the legal tutors of the participants, and we do not ask for any personal data in the questionnaires that they filled in for different phases of the project.

B. In the classrooms

The mentors and the schools schedule six sessions. We recommend not to implement more than once per week or less than once every three weeks. On that basis, depending on the availability of each mentor and the school, the sessions are scheduled.

C. Evaluation

After each session, we ask the mentors to complete a simple questionnaire to share the highlights of their experience during that session and give feedback with any information that may be useful to improve the program.

Also, after the six sessions, the mentors, the girls and boys and the management of the school, are asked to complete a questionnaire to assess satisfaction with the program as a whole. Afterwards, we analysed the most critical data.

D. Evaluating the experience

Inspira STEAM is a living program in constant revision and improvement. Since the first edition, held four years ago, we have periodically and through various means collected opinions of participants and their suggestions for improvement. All this information is processed and evaluated, and we make improvements considered essential and necessary for the resources and methodology of the project.

As commented above, one of the sources of information is the questionnaire that the mentors complete at the end of each session, and also at the end of the program. Many of them participate in the community or send us their comments and suggestions via email.

Since the first year, we celebrate a closing day with the mentors. In the last edition, we also hold this closing day in the nodes in Catalonia and Madrid. Through a two-hour session, the mentors were asked to share their experience with Inspira STEAM, to enrich the program with the resources and activities they used successfully and to leave a testimony (e.g. video, letter, mural) for future mentors or dissemination in general.

Nodes in Spain and Chile

People and entities aware of the problem of the lack of scientific-technological vocations among girls have heard of the Inspira STEAM program and shown us their interest in carrying it out in other regions of Spain. Thus, in 2017 the project expanded to Catalonia and Madrid; in 2018 the provinces of Cádiz and Vigo joined; Asturias, Segovia and Jaen in 2019; and Murcia and the Canary Islands will launch the project in the course 2020-2021. Therefore, in recent years, we have worked to systematise the entire process, and the correct management of all the resources developed (e.g. materials, questionnaires, datasheets, etc.) so that Inspira STEAM launches in new nodes can be as easy as possible.

There is no cost to launch a new node, and we all work to make the project sustainable. In this sense, the economic model that follows the project is to reinvest all the funds obtained, supporting the launch of new nodes, the development of existing ones and developing resources from which all the participating girls and boys benefit, regardless of which node they are.

The work developed by members of the team in Chile during the summer of 2019 will allow Inspira STEAM to be launched in two regions of Chile through universities, in Valparaíso and the Metropolitan Area of Santiago. We already have a group of 45 mentors who will start working with girls and boys as soon as the situation allows, foreseen October 2020.

4. Results

Following, we show the most important data regarding the implementation of Inspira STEAM. First, we show the impact it has had in terms of participation and subsequently, the results of the evaluation of the experience by the participants.

4.1. Evolution of the scope of the program

Inspira STEAM started in the Basque Country in the academic year 2016-2017. In that edition, 17 mentors participated in 11 schools, almost all located in the province of Bizkaia. You can see the evolution of the program in this region in Fig. 1 and in Fig. 2 the significant increase in the number of girls and boys who have participated in these four editions, with a total of 6,300 girls and 6,000 boys.

Fig. 1. Evolution in schools and mentors participating in Inspira STEAM in the Basque Country

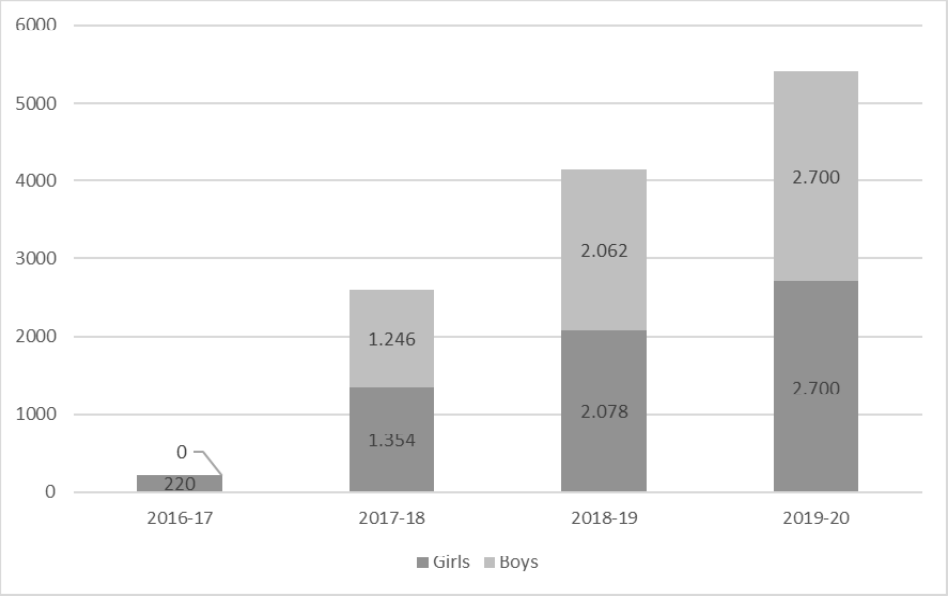
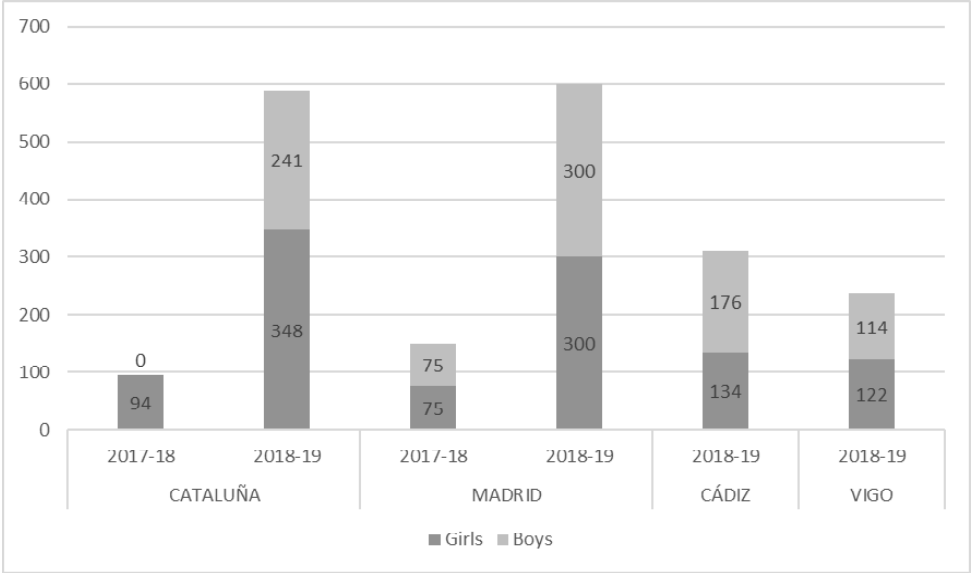
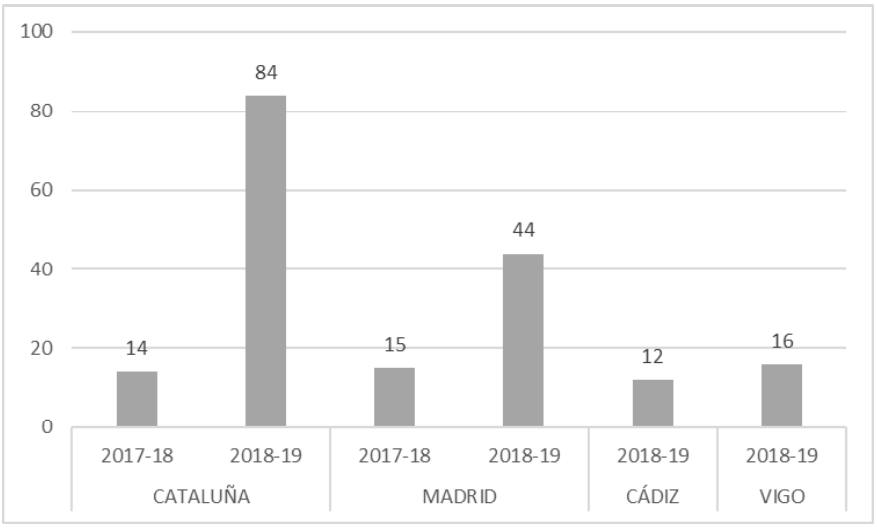


Fig. 2. Growth in girls and boys participating in Inspira STEAM in the Basque Country



The nodes have had significant participation in the program and in those who repeat, you can see the participation growth is also very high (see Fig. 3 and Fig. 4).



4.2. Assessment –mentors

Below are the main results of the questionnaires completed by the mentors of the Basque Country at the end of the program (N = 70), divided into four blocks of questions:

- *Motivation* to work in the program (Fig. 5).
- *Need* for a program like Inspira STEAM.
- The assessment of different aspects of the *implementation*.
- Degree of the fulfilment of their *expectations*.

The mentors gave a very high assessment of the need to make issues related to the lack of equality between men and women much more visible (9.24 out of 10) and also the need to promote scientific-technological vocations among girls (9.12 over 10).

Concerning the implementation of the program, its response in all items is very positive (see Fig. 6), highlighting those related to support and communication with the project team (9.09 out of 10). The materials provided for the sessions (8.14) and the training received also get a very high grade (8.03).

Finally, regarding the expectations of the mentors and their compliance, a very high score can be observed in all the questions raised (> 4 out of 5). It is seen that they value their performance in the project less positively than the experience as a whole (see Fig. 7).

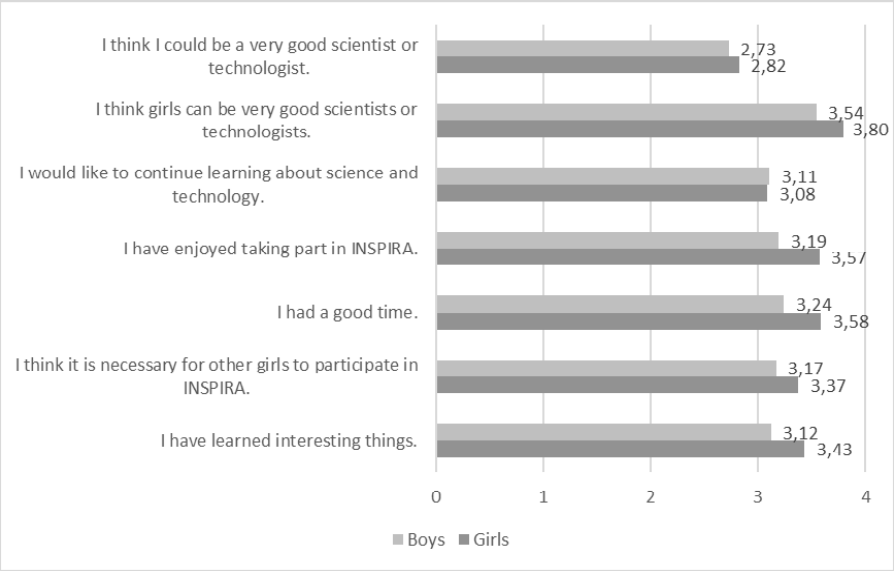
Fig. 7. Mentor expectations, degree of personal and global compliance in the program.

4.3. Assessment of the experience–girls and boys

In this section, we show data about the girls and boys who have participated in Inspira STEAM. Students answered a satisfaction questionnaire completed at the end of the six sessions that make up the program. First, we show some data describing the sample.

		Gender		Age (years)			
	N	**F**	**M**	**10**	**11**	**12**	**>13**
País Vasco	1,762	882	880	9%	58%	28%	5%
Cataluña	109	58	51	0%	69%	30%	1%
Madrid	218	112	106	0%	56%	28%	16%
Cádiz	54	27	27	0%	0%	83%	17%

Next, the answer to the questions posed to girls and boys by gender, adding the data of all the nodes.



Finally, one of the controversial issues of the program is to separate girls and boys in different spaces during the sessions. The girls work with a mentor, and the boys do it with a female or male mentor, or with someone from the schools. Although more research is needed in this regard and is one of the critical questions to address in the next edition, asked about how the girls and boys who have already participated in Inspira STEAM would like to do the sessions, you can see their answer in Figure 7.

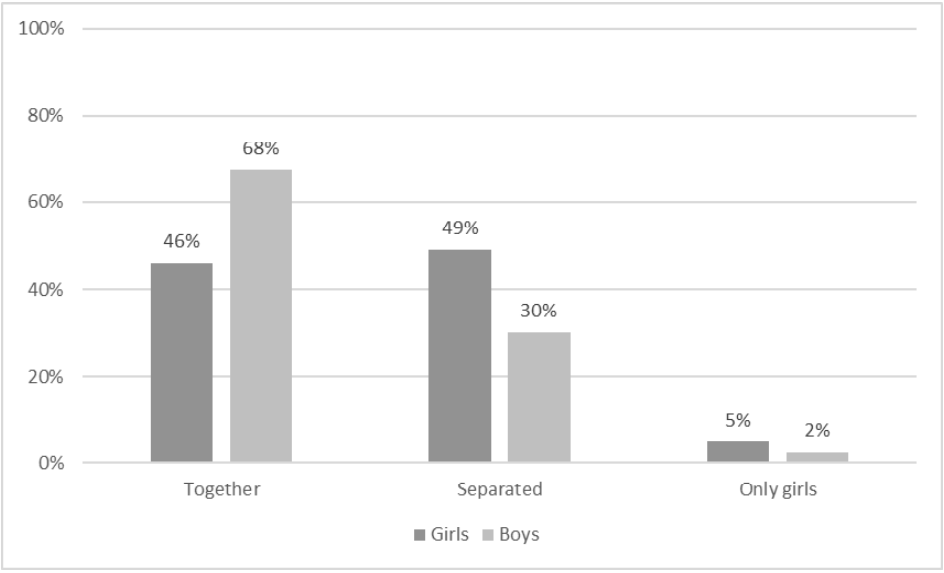


Fig. 7. Percentage of girls and boys who choose each of the methodologies proposed in the classroom: girls and boys to work together, to work separately and the option that only the girls participate in Inspira STEAM.

5. Discussion

Programs like Inspira STEAM are born because women are not entirely free to choose whether they want to pursue scientific or technological careers or not. On the contrary, their professional options are strongly limited by cultural prejudices about their group's abilities or lack thereof. Seeing other successful women in STEM, such as mentors, could free young women from the current generation of a socially restricted view of their abilities (Stout, Dasgupta, Hunsinger, & McManus, 2011).

As we have seen, the interest in STEAM is very much determined by the confidence and self-concept of girls in their abilities. The difference that the results show to the general question about women "do you think a woman can be a good scientist or technologist", with a score of 3.8 out of 4 (which the girls themselves grant), contrasts with the perception of whether they –in the first person– could be good scientists or technologists (2.82 out of 4). This result is in line with previous authors' conclusions that associate the lack of interest in STEAM studies with the self-concept (Britner, 2008; Zeldin, Britner, & Pajares, 2008; Virtanen, Räikkönen,

& Ikonen, 2015), also the relation of self-confidencewith success in technological higher education (Engström, 2018).

To improve this self-concept, Inspira STEAM uses professional STEAM women who serve as role models for girls and boys. The contact of women with experts of the same gender (peers, professionals, teachers) in an academic environment improves their self-concept, their implicit attitude towards science and technology and their implicit identification towards these disciplines; increases self-efficacy in these areas and the motivation to continue STEM studies (Stout et al., 2011). On the other hand, the subjective identification towards STEMs, favoured by contact with female referents in those areas, makes the path from the present-self to the future-self more concrete, since one can imagine emulating the trajectory of the successful member of the group (Markus & Nurius, 1986).

Another issue analysed in the study is the preference of girls and boys to work together or separately in the Inspira STEAM sessions. Although the percentage is similar in both options, it is significant to see the difference between girls who want to do it alone. Previous studies show the importance of having peers who support them, both socially and in their education. Probably, the creation of active groups of female students is a way to challenge the masculine norms found in scientific-education (Engström, 2018). Besides, when women have access to behavioural models and peers with whom they can identify, they tend to remain within the areas of STEM specialisation (Zawistowska, 2017).

As for the mentors, we also perceive a lack of confidence in several phases of the process. Starting in the training itself, where they often share feelings of "responsibility", "fear of not doing well", "vertigo" with others such as "illusion" and "empowerment." Some also stated that they had doubts when they signed up for the program because "they didn't see how they could be a reference" or because they considered that the word "mentor" was too big for them.

At the end of the process, the mentors value elements of their experience in the program very positively, including the motivation to participate, implementation of the program, and a degree of compliance. However, of all the questions posed the worst-rated are: "I feel that I have fulfilled the objectives set within the Inspira project ","I feel that the girls and boys have internalized the message that I wanted to convey to them "and" I feel that I have managed to transmit the contents adequately…". We see that, again, these items are related to the confidence that mentors have in their performance with girls and boys. That is why we consider the network of sorority that is created in Inspira STEAM very important since it also provides an environment of confidence and empowerment among women. This social support and the creation of strong groups of women is a way to challenge the masculine norms found in scientific education (Engström, 2018).

6. Conclusions and future research

Inspira STEAM works to address issues identified as barriers in girls' access to studies and professions in the scientific-technological area. Among them, there are two that have a particular impact throughout their life, such as trust and female STEAM referents. The 10-12-year-old girls we work with still have a good self-concept of the female gender in general, but this confidence is not so strong when asked about their own ability to develop a STEAM profession. We strengthen this trust with mentors with whom they can project their tastes and interests as well as share their concerns and doubts.

Mentors also indicated a lack of self-confidence throughout the process: from the impostor syndrome that makes them doubt their ability to be a mentor, the responsibility, vertigo and fear of facing the sessions in the classroom, to the assessment of their performance in the program. For this reason, the participation of mentors in Inspira STEAM is not only beneficial for girls, but the mentors themselves strengthen their confidence, value their work in the program and feel useful to the girls with whom they work, and to the larger society. All this is thanks to the shared space between the mentors and the support network that emerges from the moment of the training and continues in the sessions conducted in the schools.

The limitations of the study are determined, mainly, by the lack of an experimental investigation to evaluate the variables that affect the program (self-concept, attitude towards technology, female STEAM referents), and that would provide more information on the barriers of the girls to opt for studies in science or technology. In the fourth edition, we are working on a rigorous measurement of these aspects.

We value the results of the program very positively in terms of the satisfaction of the participants, both mentors and students, and the implementation in schools. Indeed, in the edition 2019-2020, the number of mentors has increased to 250 women and 18 men working in 80 schools in the Basque Country. Moreover, Inspira STEAM is also running in many regions in Spain (Catalonia, Madrid, Andalusia, Murcia, Asturias, Galicia) and starting in Chile. However, we face many challenges in different aspects of the project. The most relevant are working with families and socialising the problem beyond the classroom; improving data collection to have more quality data to analyse the impact of the program in boys and girls; and improving the implementation tools and procedures to better monitor participants' progress and support.

The success of Inspira STEAM can also be measured by the mentions and awards received. It has been awarded the Fundación Telefónica prize for the Educational Volunteering, the Buber Prize by the Internet Euskadi association, the Dona TIC prize given by the Generalitat of Catalonia, the University Social Commitment Award by Aristos Campus Mundus; also, Inspira STEAM is recognized as an example of innovative experience collected in the Report Portrait of Volunteers in Spain –Fundación Telefónica and mentioned as a Relevant Initiative in the White Paper on Women in Technology edited by the Ministry of Economy and Business.

In future editions, it would be necessary to inquire about the causes that cause girls' lack of confidence in their STEAM capabilities and propose actions to overcome it, such as including practical programs that show them that they are capable of solving STEAM challenges. We are also working in various regions in Spain and Chile, and it would be interesting to analyse the cultural differences that affect girls in the examined dimensions.

The results of this study highlight the need for girls and women to have STEAM references nearby to whom they can relate, and the tremendous job that remains to reaffirm the confidence of girls and women in their capacity, especially that related to mathematics, which is so strongly associated with studies in science and technology.

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