



GENDER AWARE EDUCATION AND TEACHING IN STEM

Collection of resources and best practices



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INTRODUCTION

"Girls are not talented at science", "Science is for geeks and thus not for girls"...

This publication aims to present best teaching practices collected during the implementation of the Erasmus+ project between 2018 and 2020 in five European countries, with six partners.

The digital platform includes a self-assessment tool, which enables teachers to take stock of their own gendered education practices. Depending on each teacher's profile, the tool recommends learning content to help them better managing gender diversity in their classrooms. Based on education resources made available on the online platform, which included up to 100 contents, all built on existing resources, curated or newly created by partners. This new resource is a comprehensive guide for those who want to understand more about the current situation regarding girls in STEM and are interested in taking action to close the gender gap in STEM teaching.



It presents the research around stereotypes in STEM teaching conducted with pupils and in schools, as well as material to prepare to teach, to provide career guidance and counselling, and to raise awareness. This publication mainly showcases newly created resources by the partners, based on their own area of expertise, including pedagogical and teaching resources. The booklet is a complementary exploitation resource to the ones already available on the platform, created for those who are interested in the topic and would have a preference for books and printed resources. The selection of resources also reflects the most relevant resources designed by the partners and aims to contribute to larger dissemination of the project results.

We hope that you will find this publication informative, actionable and inspirational.

DESCRIPTION OF THE ERASMUS+ PROJECT

The main objective of the project is to promote and support teachers in dealing with gender-balance and diversity in their classrooms. It aims to tackle the low representation of girls in STEM education (Science, Technology, Engineering and Maths) and subsequently women in STEM careers.

The problem includes an European dimension, as several studies and recent statistics have shown. Yet, a Commission's study (2015) found that more women entering the digital jobs market could create an annual € 9 billion GDP boost in the EU area.

Besides improving operational and financial performance, investing in women also increases innovation, allows better problem solving and group performance, and enhances company reputation (Anita Borg Institute, 2014). Nevertheless, STEM education is still characterized by a large gender gap and, because women are underrepresented in STEM sectors in most countries, they are a significant source of untapped talent.

However, several problems prevent girls from fully participating in STEM, among them cultural traditions and stereotypes, as well as unconscious biases about girls in STEM education (e. g. science is solitude, science is more suitable for men...).

The Gender 4 STEM project managed to develop with target groups an innovative and personalized learning solution: an online platform recommending high added-value materials and training associated with the curricula of teachers. It also aims to engage target groups in exploitation and dissemination activities to promote its use

Then the needs are twofold:

- Erase unconscious biases and gender stereotypes in STEM education by raising awareness of target groups;
- Support teachers by providing them materials to deal with diversity and gender-balance in their classrooms (e. g. helping them to design suitable education programs, organize hands-on activities, promoting STEM careers...) and then engage more girls in STEM education.



The project has targeted three groups:

- Teachers and especially teachers in STEM, psychologists and career advisors in lower and upper secondary school; the first beneficiary of project results.
- Head of teachers, schools directors and teachers' training centers; they promoted the use of the project solution.
- Youngsters of 11-18 years old; the final beneficiary of project results. According to current reports, we can fully act on this age range to engage more girls in STEM careers.

Gender 4 STEM has activated partners and associated partners from Central, Eastern and Southern Europe where gender inequalities in STEM education are seen, but where good practices to engage more girls in STEM careers are also to be found (e. g. makers paces like Be Creative or the campaign Girls in ICT in Luxembourg ...).

To build a high-quality project, Gender 4 STEM brought together a variety of partners with expertise in gender issues, especially in the field of STEM (VHTO, Smart Venice, Women in Digital Initiatives Luxembourg), (e-)learning and teaching (Consulio, Professional Foundation) and technology research and development (LIST, Consulio). Each partner has also a strong experience in project management and collaborative innovation. In addition, we can observe – regarding figures in 2012 - in the consortium good mix in terms of gender equality index in Knowledge above European index (49,1): Luxembourg, Netherlands and a group above the European index: Croatia, Romania and Italy.

The Gender 4 STEM project methodology was based on a design thinking approach, so that target groups and main stakeholders would be involved in designing a suitable solution. It was structured in seven intellectual outputs, among them the prototypes of the platform "Gender 4 STEM Teaching Assistant" and the "Gender 4 STEM training for teachers". Seven multiplier events have promoted the project results at local/regional and national level and EU level during Romanian and Croatian EU presidency.

The project relayed on a strong network of around 50 experts in Europe involved in expert committee active during all the duration of the project. A strong reflection about project results sustainability allowed us to plan the transfer of the solution to other sectors like Adult Education. Indeed, gender stereotypes were also experienced in the workplace and the solution could be useful for recruitment and HR management to engage more women in STEM sectors (like digital). Then Gender 4 STEM project results will support CHRO, recruiters, managers... in frame of their missions.



OUR PARTNERS

Smart Venice

Smart Venice is a start-up founded in 2014 on the initiative of Italian entrepreneurs and professionals with multidisciplinary local and international expertise inspired by the idea of new patterns of urban sustainability. The company aims at promoting initiatives and offering services that enhance environmental and social sustainability and foster digital social innovation in urban contexts based on social inclusion, interaction with and active engagement of local communities.

PRoF

Foundatia Professional (ProF) is a non-governmental, non-political and non-profit foundation, aiming to promote high quality in education, intercultural tolerance and appreciation, life-long learning, human rights, fight against poverty and discrimination, and social inclusion.

WIDE

Women in Digital Initiatives Luxembourg Asbl (WIDE) is a non-profit organisation that has now become the leading and national reference organisation to champion inclusion of girls & women in the new technologies and digital field.

VHTO

VHTO is the Dutch national expert organisation on girls/women and science/technology, makes an effort to increase the involvement of women and girls in science, technology, engineering and mathematics (STEM).

LIST

The Luxembourg Institute of Science and Technology (LIST) is a Research and Technology Organisation (RTO) helping to enhance Luxembourg's competitiveness and its position as a global hub for excellence in research and innovation. LIST transfers outcomes of applied research to support public and private companies in mastering problems of practical relevance and boosting innovation.

Consulio

Consulio Inc. is designed to assist spin-off companies through every step of their business journeys. The road to commercialising a product idea or revolutionary new service is difficult and filled with obstacles. Consulio Inc. is available to help companies find resources to overcome these obstacles.

COMMONLY HEARD STEREOTYPES

In this part, you will find several stereotypes linked to girls in STEM. These situations are based on research conducted in schools in partner countries, with pupils in 2018-2019. These stereotypes are illustrated with drawings, made by the pupils themselves.

They highlight well the kind of stereotypes girls are still facing nowadays when it comes to studies and careers in STEM.




STEREOTYPES IDENTIFIED IN THE PROJECT

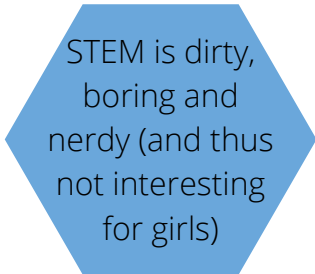
Resource created by LIST

This resource is the result of workshops with students and teachers in European Secondary Schools. Girls from all over Europe draw cartoons on what it means, according to them, to be a girl in STEM. In total, six workshops were organized, from December 2017 to January 2018. The workshops took place in five European countries: Croatia, Italy, Luxembourg, the Netherlands and Romania. Fifty-five pupils had the chance to participate in these workshops, during which fourteen stories were produced! These cartoons are a clever way to better understand how girls might feel about being a girl in STEM.


The girls told stories about the stereotypes that keep them from pursuing STEM. Among these stereotypes, the ones that occurred the most were the following:



Girls are
(hardworking) but
do not have talent
for STEM



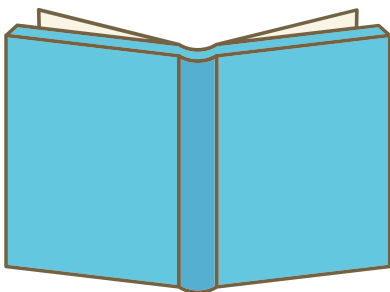
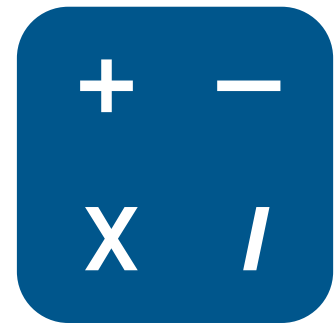
STEM is dirty,
boring and
nerdy (and thus
not interesting
for girls)



Women do not
belong in STEM

Moreover, it appears that:

- Many girls don't have a realistic image of STEM
- Many girls don't know which professions and working environments are part of STEM
- Most girls are unaware that a job in STEM can entail creativity, team work and helping others



- People strongly associate STEM with men (implicit bias)
- STEM textbooks and teaching materials are mainly tailored to boys
- In many cultures, caretaking responsibilities are placed on the shoulders of women, making it hard for them to pursue a career in STEM

- Boys get asked significantly more questions in STEM class
- Some teachers assume that girls only get good grades at STEM because they are working hard
- ... and that boys are lazy, but that they compensate that with an innate talent

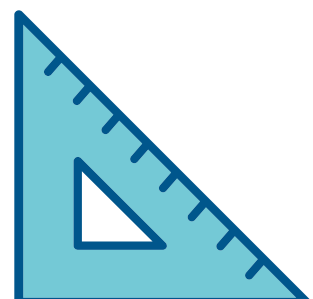

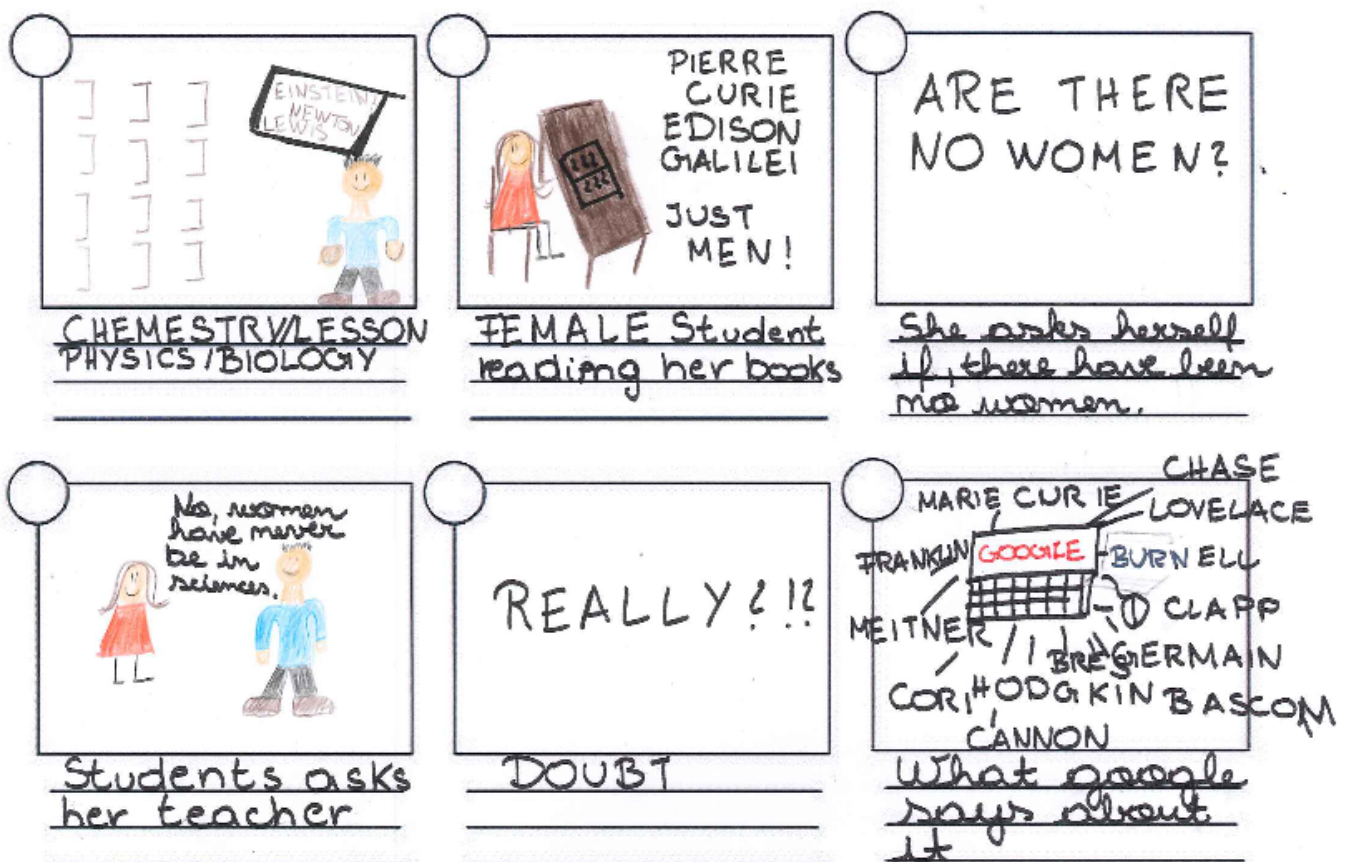


Table with the stories created by girls in each country

Country	Related stereotypes	Name of the story	Related teaching situation
	Girls (are hard-working, but) do not have talent for STEM	Boys are not better at computer class	Teaching
	Girls (are hard-working, but) do not have talent for STEM	Because she is a girl	Teaching
	Girls (are hard-working, but) do not have talent for STEM	What to do now?	Career advice
	Girls (are hard-working, but) do not have talent for STEM	Boys are (not) better at technology	Teaching
	STEM is nerdy, boring and dirty and thus not interesting for girls	Electro calling	Career orientation
	Girls (are hard-working, but) do not have talent for STEM	The score	Grades, Pupil-pupil interaction
	Women do not belong in STEM	Women who made history	Teaching materials
	Women do not belong in STEM STEM is nerdy, boring and dirty and thus not interesting for girls	Girls turn to neutral studies	Grading, Career orientation
	Girls (are hard-working, but) do not have talent for STEM	The bad grade	Grading, Pupil-pupil interaction
	Women do not belong in STEM	The astronaut	Career orientation
	Women do not belong in STEM	The skills	Pupil-pupil interaction
	Girls (are hard-working, but) do not have talent for STEM	Science	Teaching
	Girls (are hard-working, but) do not have talent for STEM	Technology	Teaching
	Girls (are hard-working, but) do not have talent for STEM	Mathematics	Teaching

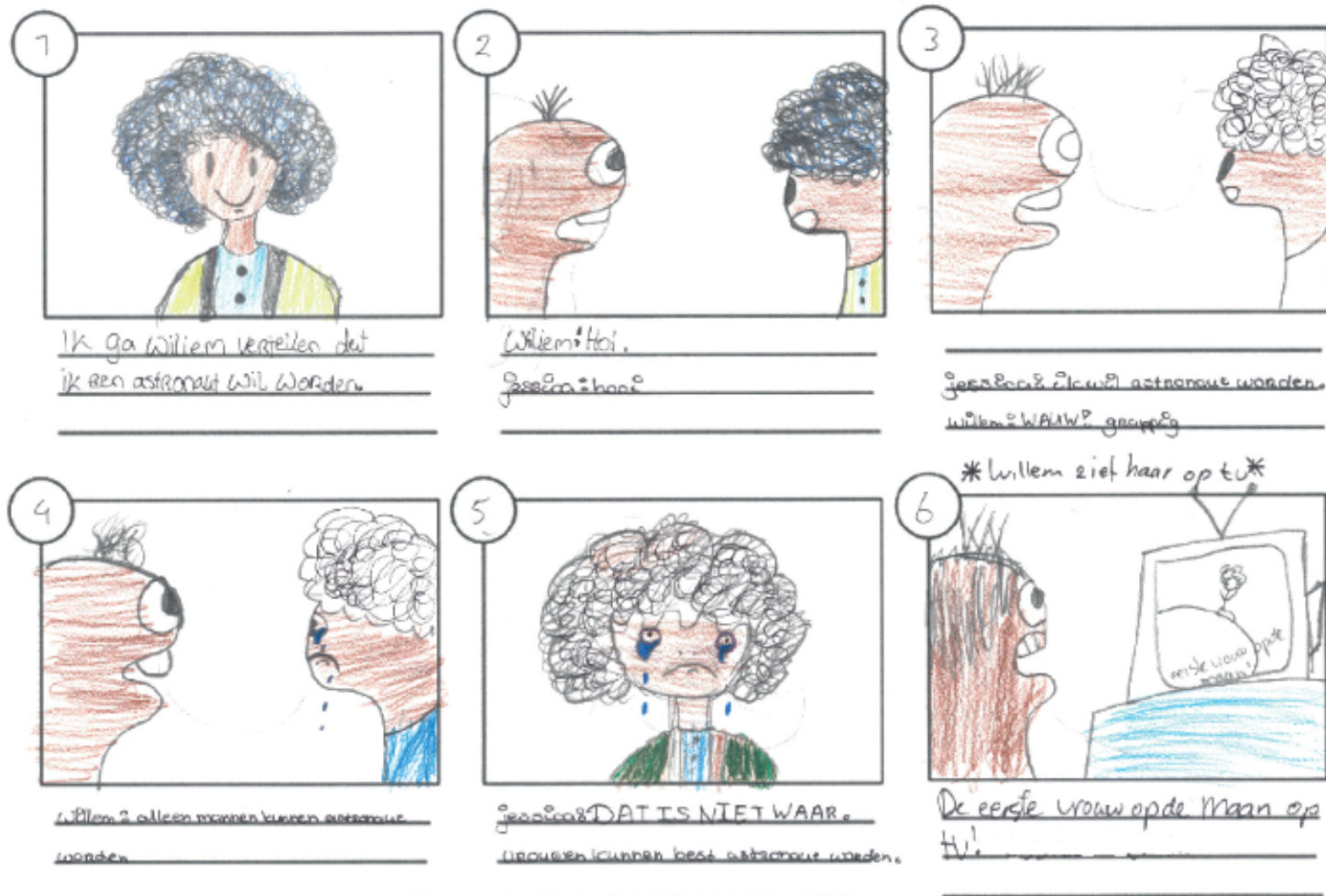
Stories related to the stereotype "Women do not belong in STEM"

Women who made history







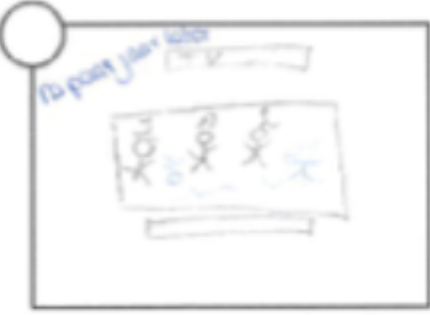

At a chemistry/biology/physics lesson, a female student is reading her books. "Are there no women in science?", she is asking herself. She asks her male teacher who answers: "No, women have never been in sciences." She googles. What google says about it: "Marie Curie, Meitner, Franklin, Lovelace, Chase, Germain, Cannon,....."

The astronaut



Jessica wants to become an astronaut and decides to tell Willem about her plans. Willem laughs at her and says „Women can't become astronauts.“ Jessica disagrees, and is very sad. A few years later, Willem is shocked to see Jessica on TV: The first woman on the moon!

The skills

NAME		NOTES
PROJECT		
 <p><u>at age 3 meigs, the internet, good</u> <u>would not get going</u></p>	 <p><u>at good school</u> <u>School</u></p>	 <p><u>Went to school in</u> <u>Wien</u></p>
 <p><u>At school we learned</u> <u>that girls are not</u> <u>girls</u></p>	 <p><u>at age 10 I was</u> <u>in the school</u> <u>where I learned</u></p>	 <p><u>and so I'm</u> <u>happy</u> <u>about it</u></p>

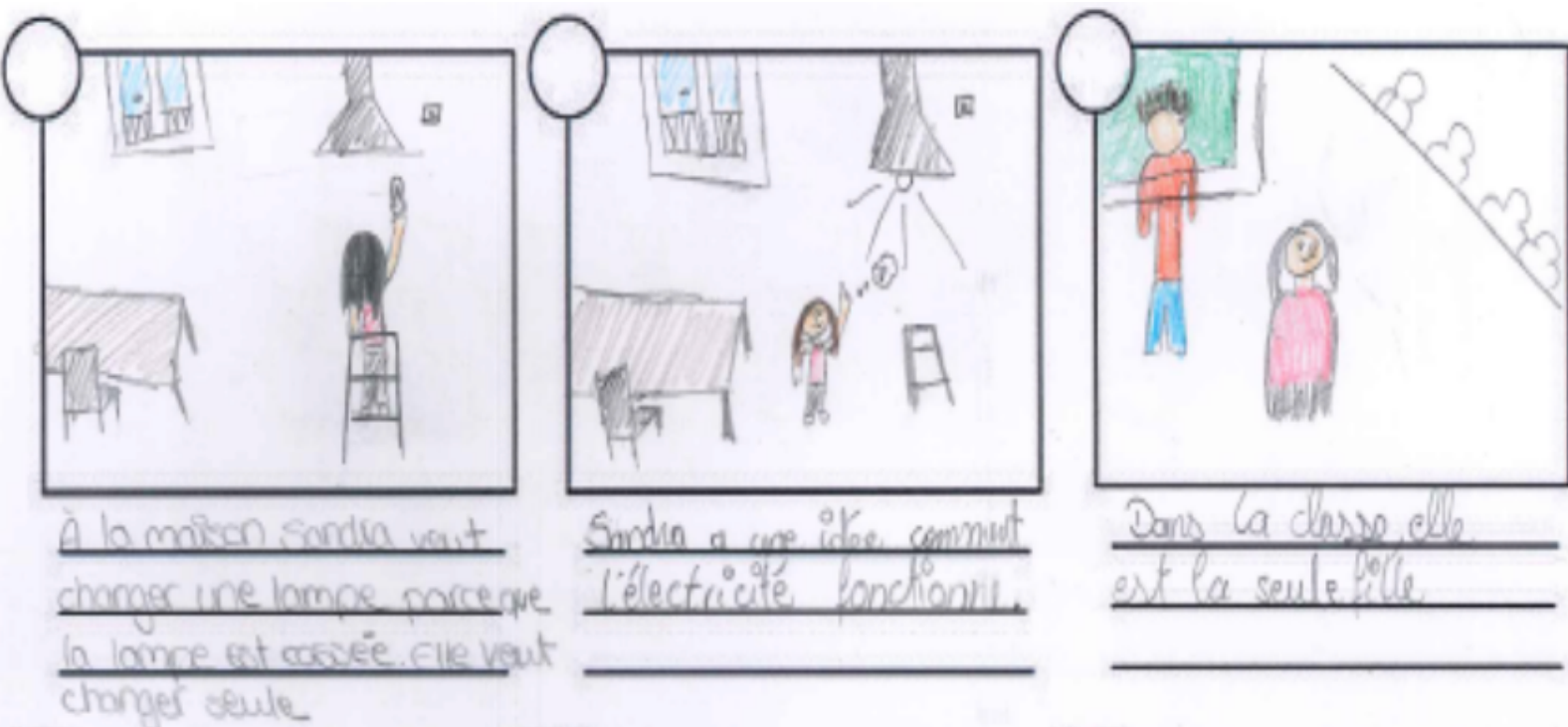
3-meisjes

meisje 1: stem, taal, wetenschappen
2. perfect: taal, productontwikkeling
3. handmatig: taal, techniek, logica, rekenen
Jonge - Alex

Three girls with different STEM skills (one is very handy, the other is very creative, the other one is good at maths) are being constantly bullied by a few boys in tech class („You can't do anything because you're girls"). A few years later, one of these boys sees them on TV. They have become a renowned builder, a famous product designer and a brilliant mathematician.

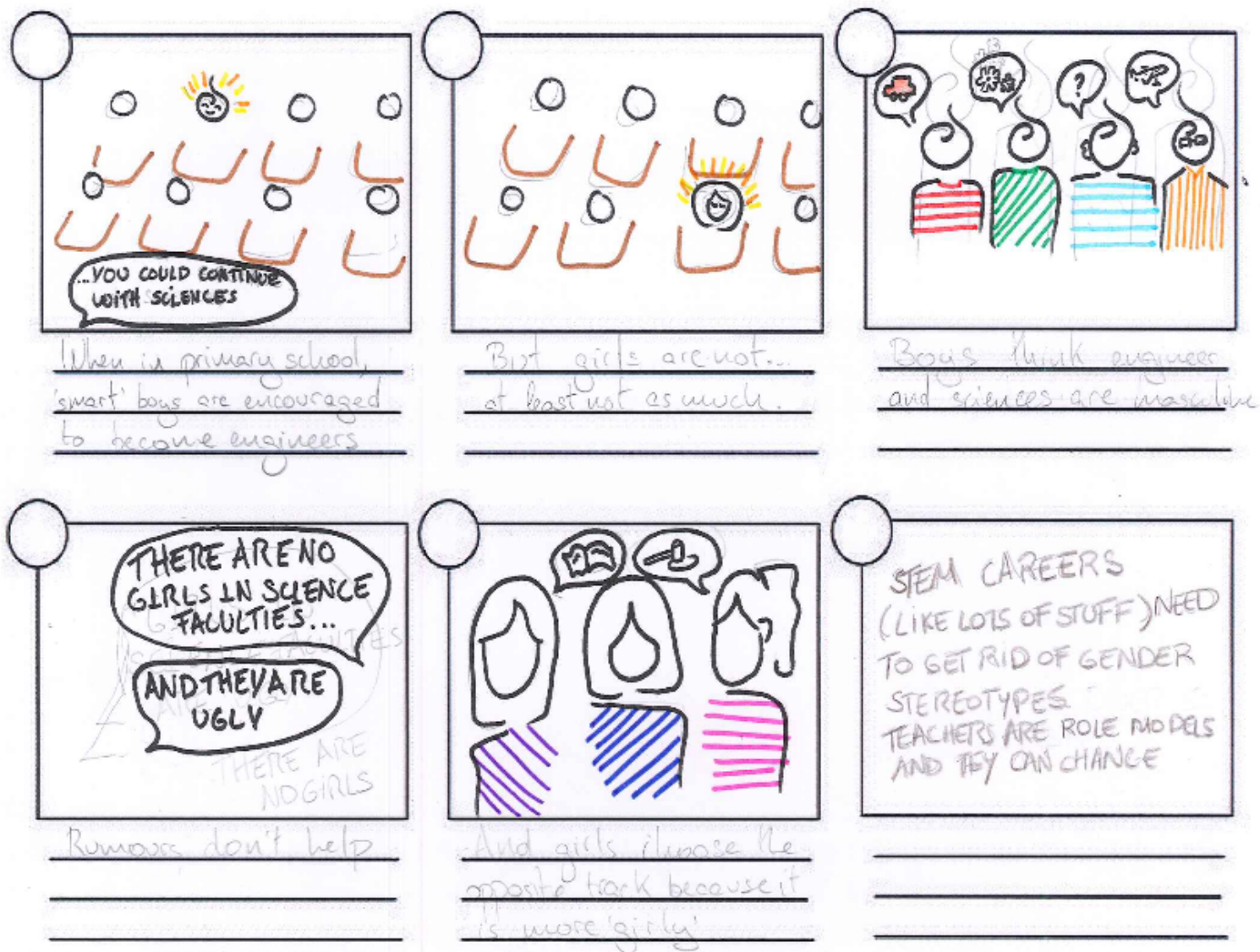
Stories related to the stereotype "STEM is nerdy, boring and dirty (and thus not interesting for girls)"

Electro calling



At home, Sandra is changing a light bulb and starts wondering about electrical circuits. As she starts school in September, she opts for an electrical domain, even though she is the only girl in the class.

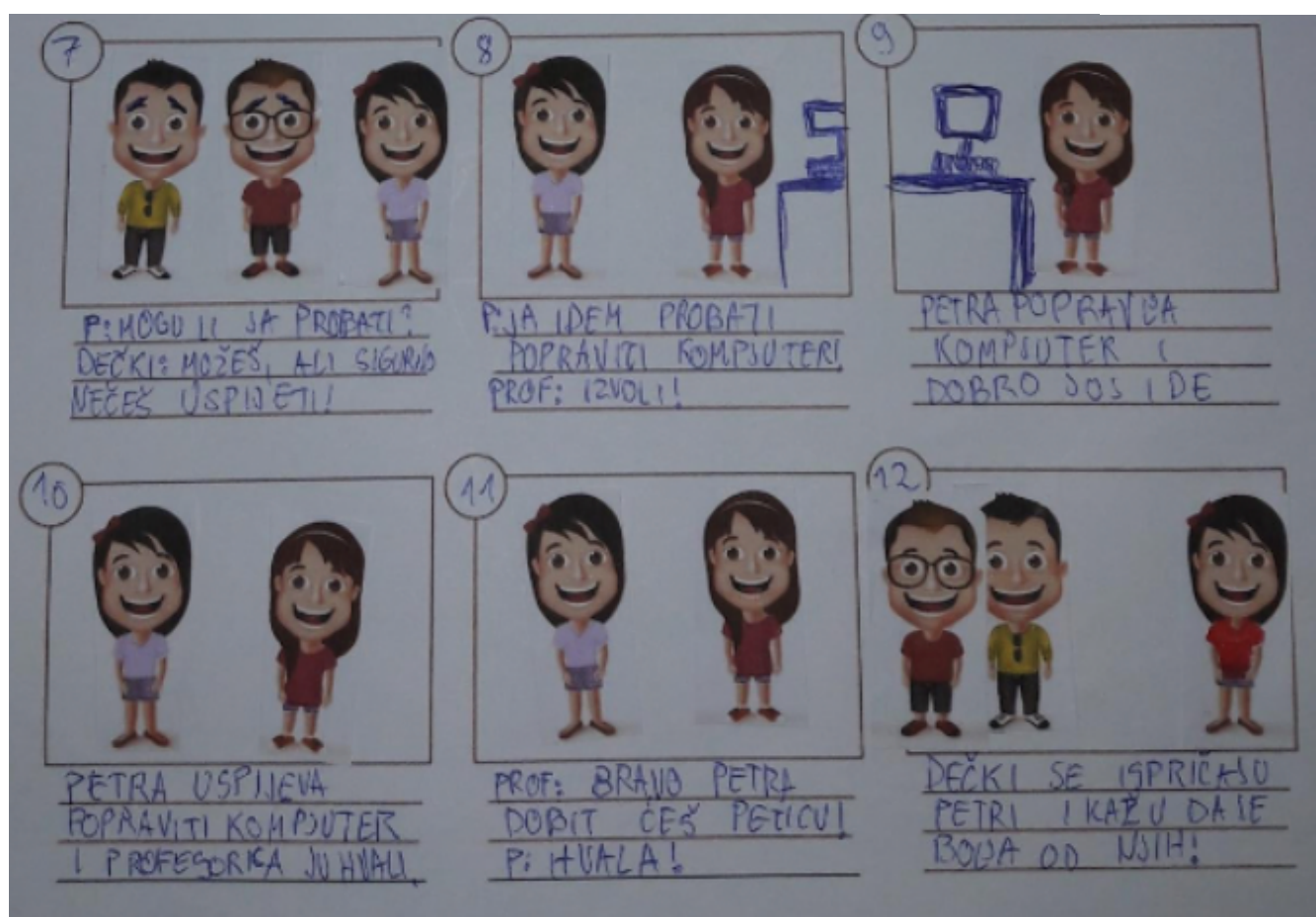
Girls turn to conventional studies



In primary school, 'smart' boys are encouraged to become engineers. But, girls are not- at least not as much. Boys think that STEM is masculine. Rumours don't help: "There are no girls in science faculties..." "And they are ugly." And girls choose other, more 'girly' subjects. STEM needs to get rid of gender stereotypes.

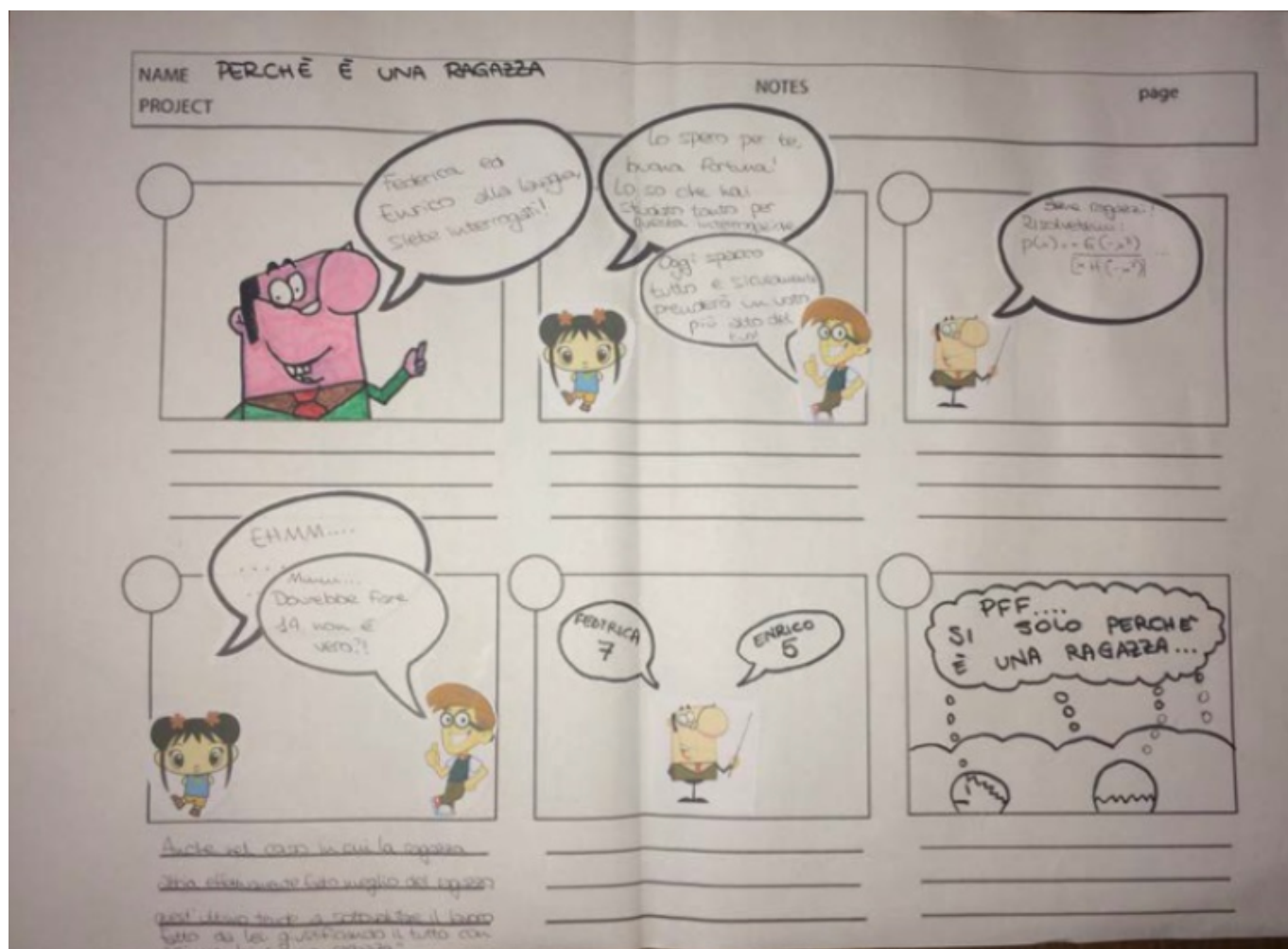
Stories related to the stereotype "Girls are hardworking but don't have talent for STEM"

Boys are not better at computer class



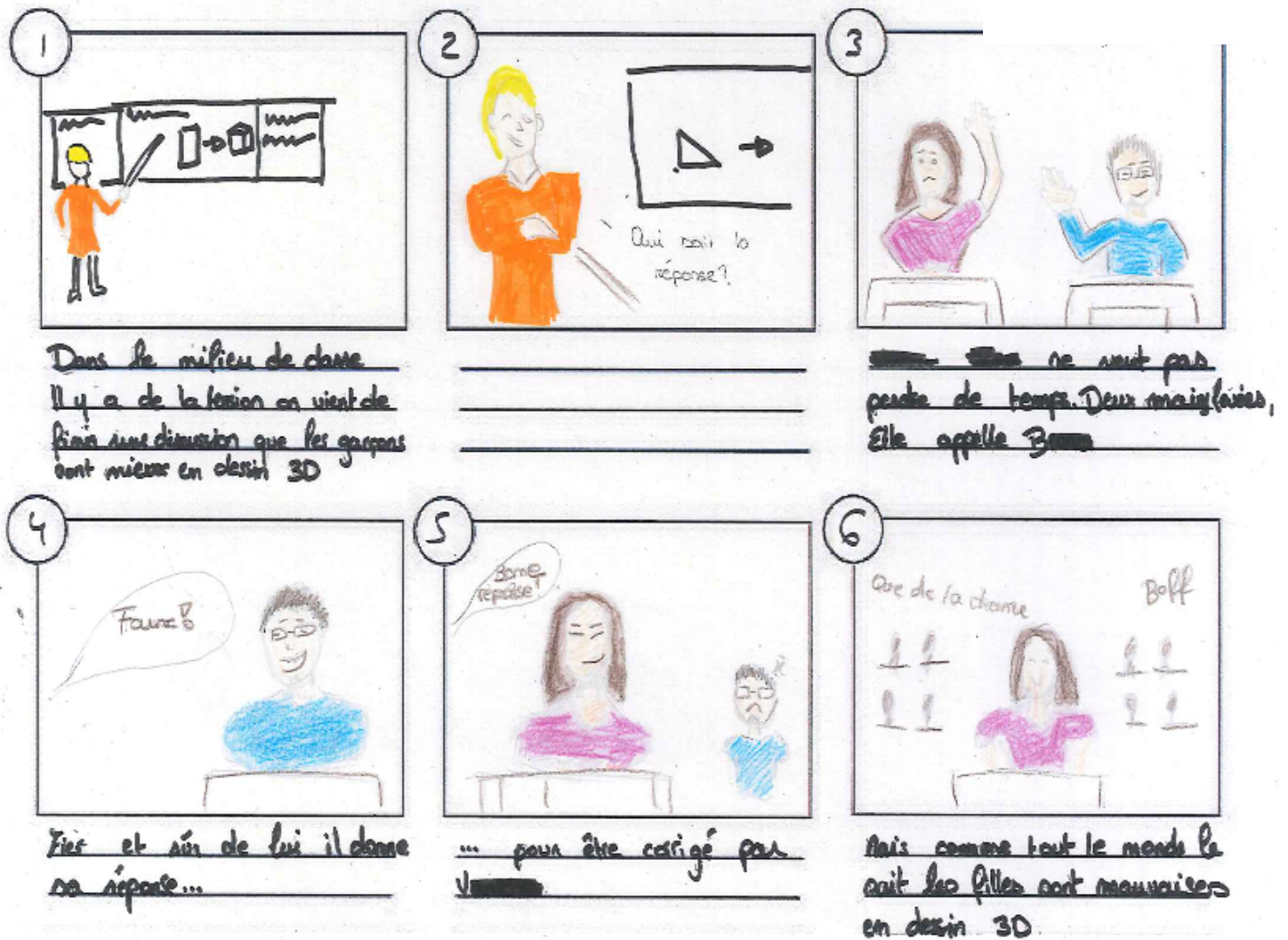
During a computer class, the teacher asks boys to fix the computer. Petra asks if she could help. The boys say „You don't know anything about computers, you're a girl." After the boys have tried unsuccessfully for a while, Petra helps them fix it. The girl concludes that your gender does not matter, since it does not define what you can or can not do!

Because she is a girl



Professor Santin calls Federica and Enrico for an oral test. Enrico seems to be very self confident about it. The teacher asks both to solve a function. Alice does not answer immediately and thinks about it whereas Enrico answers very quickly, but giving the wrong answer. At the end the teacher gives as mark 7 to Alice and 5 to Enrico. Everybody in the class think «just because she is a girl..».

Boys are not better at technology



In a 3D drawing class, the teacher claims boys are better than girls in scientific domains and technical thinking. When she asks a question, only two hands are raised to answer: a girl and a boy. Wishing not to lose time she first asks the boy who answers wrong. The girl then gives the right answer to the question, surprising the teacher and other pupils.

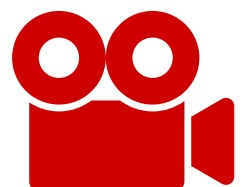
The score



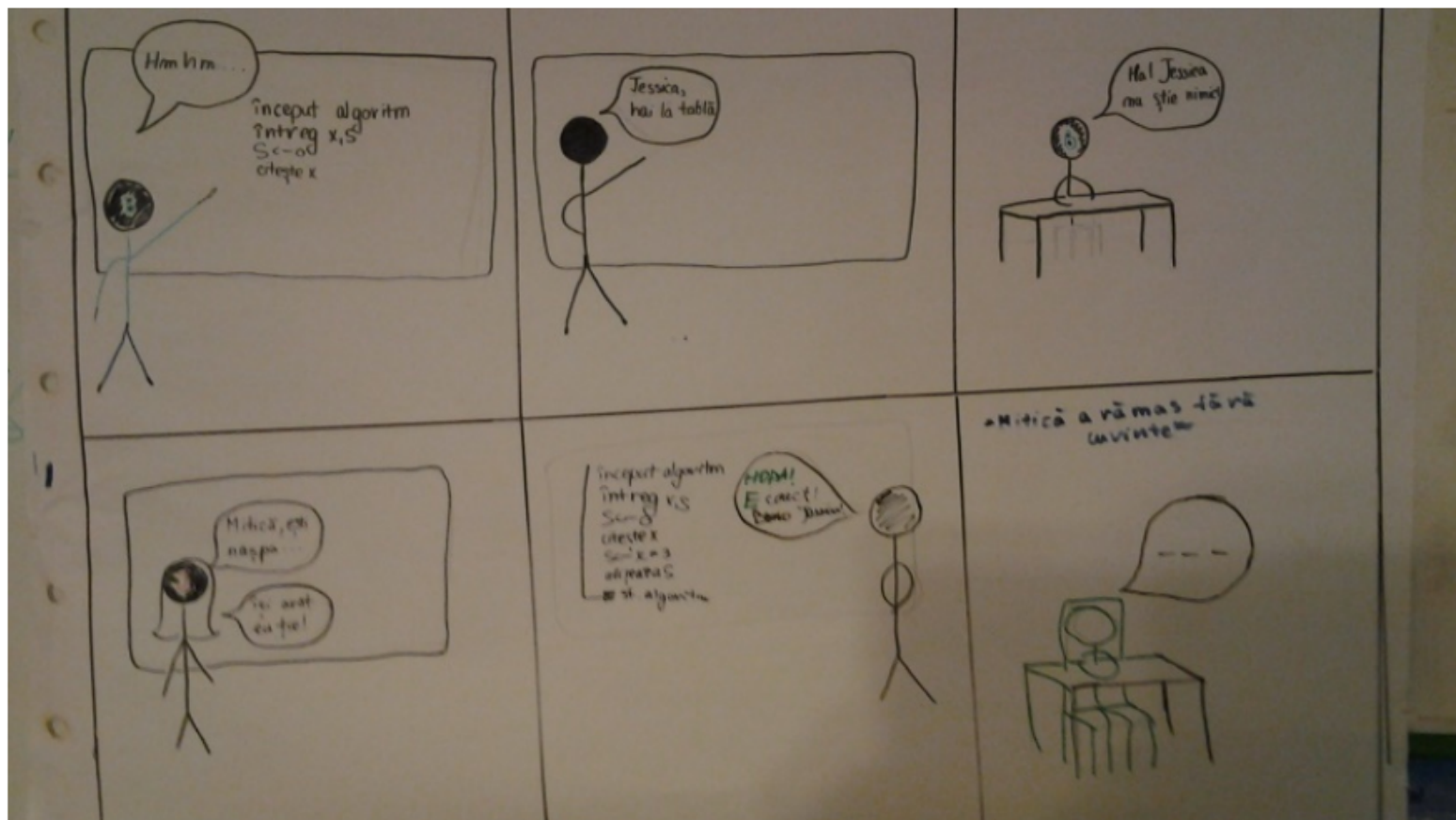
A girl tells her male class mate about her grade at ICT (a 9). He does not believe her, laughs at her and tells her that this is too good for a girl. In the end, the girl finds out that he does indeed have a worse grade (an 8).



The drawing "The Score" has been transformed into a video. This pedagogical video illustrates, therefore, a situation experienced by girls who receive good results in STEM disciplines. Boys continue to say that they are better than girls. Discover what is reality. This short video aims to raise awareness on the stereotype "Girls are hard-working but do not have talent in STEM". To watch the video, go to our Website!

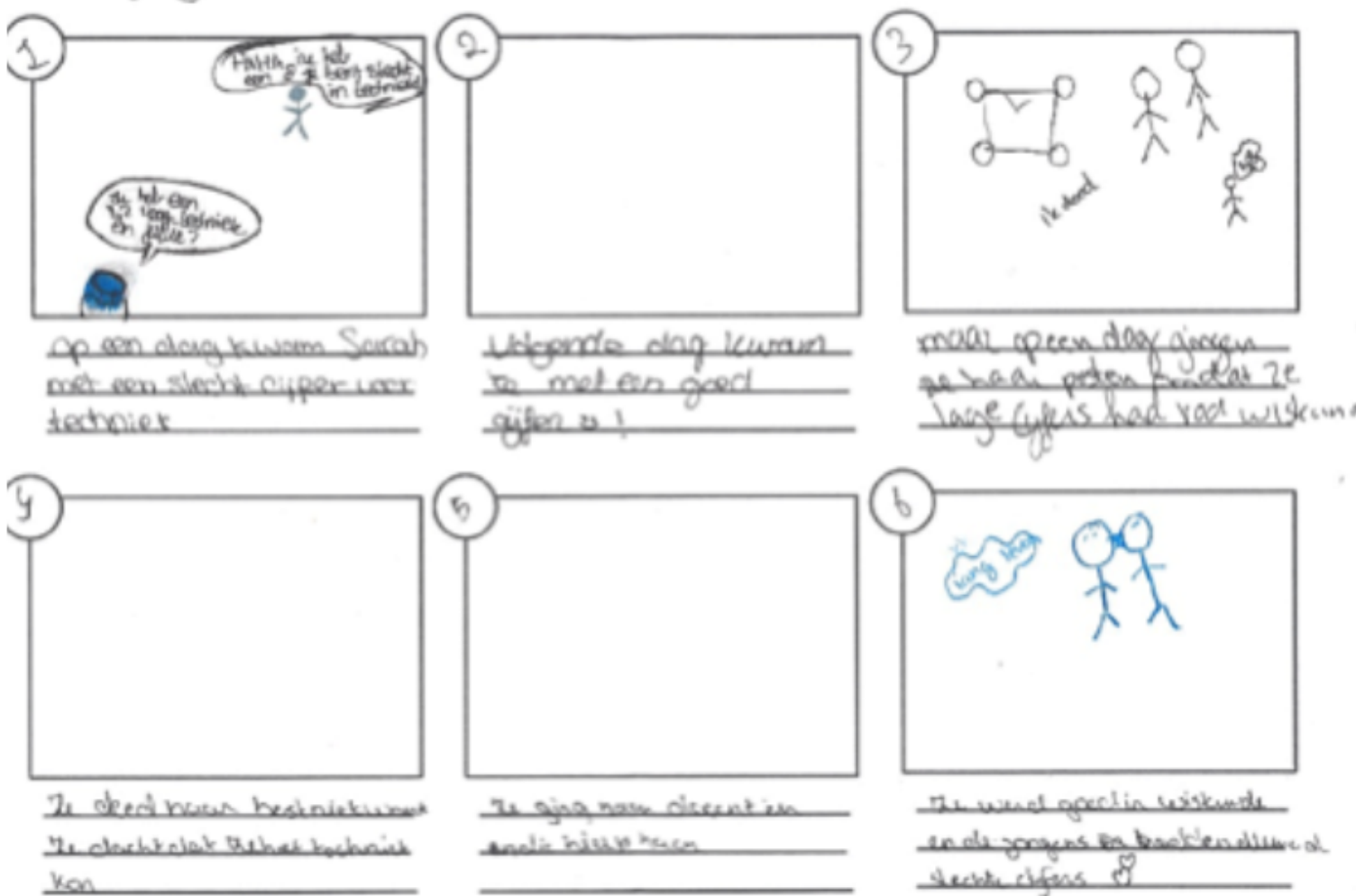


Technology



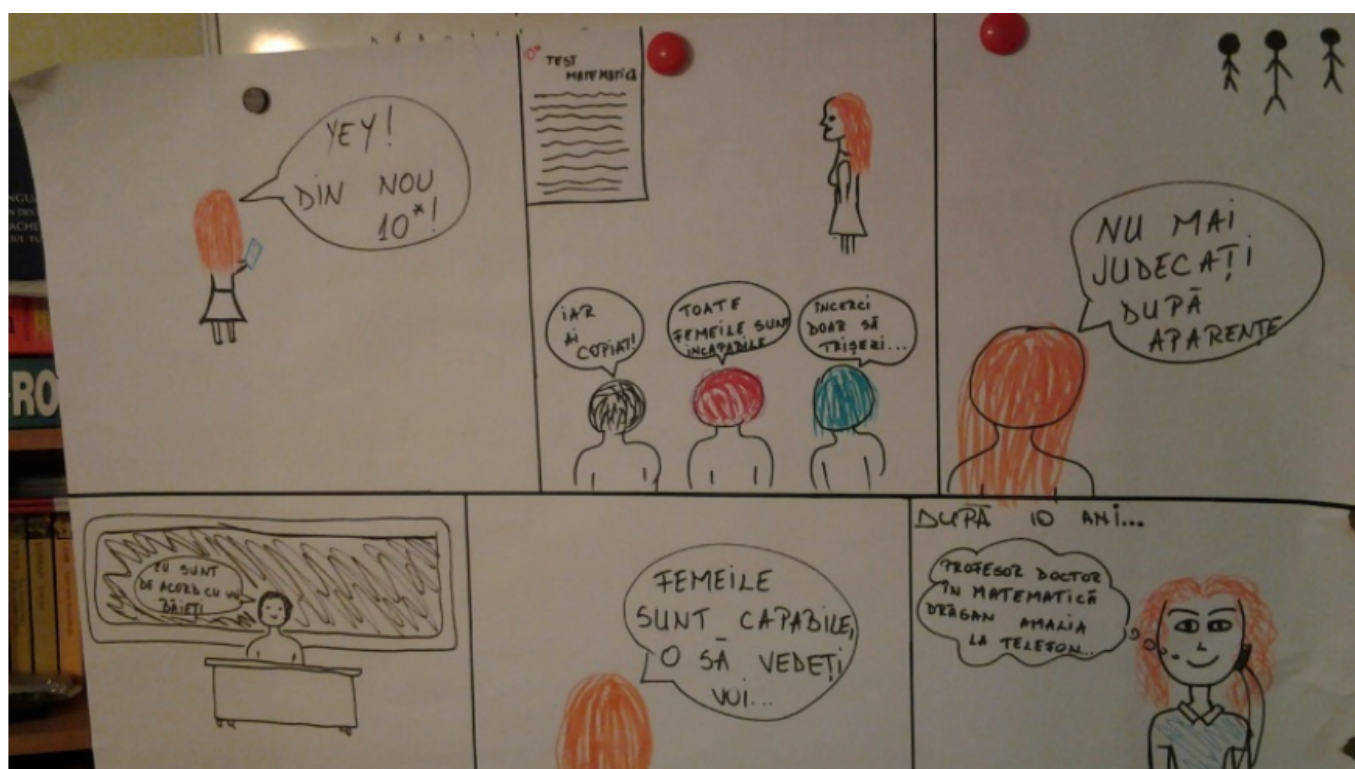
During an informatics class, Jessica is asked to complete an algorithm. Her boy classmate utters: „Jessica can't solve the problem, girls can't comprehend informatics” Jessica wants to show him, solves the problem correctly, leaving him speechless.

The low grade



Sarah had a bad grade for mathematics, but the next day she had a good grade. But a few days after the other kids in class started to bully her because she had bad grades in math. She stopped doing her best because she believed she wasn't good at tech. Finally, she went to her teacher who helped her. She became good at maths.

Mathematics



Amalia scores a 10 at her math test. The boys believe she cheated ("Women can't do this"). Ten years later, the phone of one of the boys rings:
„Hello, this is Amalia speaking”
– „Amalia who?”
– „Amalia, PhD in Mathematics, your former classmate.”



Science



A physics teacher addresses the girls in his physics class: "Have you learned your lesson, little kittens? I am going to quiz you about today's lesson."

– "Why don't you ask the boys?"

– "Boys are better at physics and I'm interested if girls can get physics after all." A girl answers the questions correctly.

Teacher: "I have to admit that this kitten can be good at physics."

Pupils from different cultural and geographical backgrounds tell similar stories on gender and STEM

Most cartoons tell a story of being underestimated or ridiculed in STEM-class. A few even receive the explicit advice to stay out of STEM. But the girls in the cartoons also almost always know how to prove themselves and be successful in the end.

The strongest stories will be transformed into an animated cartoon and made available on the Gender4Stem platform in order to raise awareness of teachers on the stereotypes on girls and STEM.

How do teachers experience these stereotypes?

Teachers from five European countries were reached: Luxembourg, Croatia, Italy, the Netherlands and Romania. In total, twenty-five teachers participated to five focus groups



Croatian teachers agree with the stereotypes depicted in the stories

At home, girls are not treated equally to boys, but in school, they are expected to act similarly.

The key strategy must be to change how girls, families and society imagine what girls can be and can do.

Parents need to see that there are real opportunities for their daughters besides being a mother and a wife.



Italian teachers have made some different experiences than students

In some situations, teachers state having different experiences than pupils:

‘Because she is a girl’: Teachers state that from their side there are no preferences connected with gender, although there might be preferences connected to individuals.

What to do now?: Teachers note that girls are usually more determined and proud than boys: being a minority might even reinforce their willingness to demonstrate that they can do it.



Dutch teachers agree with the stereotypes depicted in the stories

Teachers are aware that every student should be given the same chances in STEM class – no matter which gender. However, they admit that they have unconscious biases which influence their teaching attitudes towards girls/boys. They don't see big differences in grades between girls and boys in STEM subjects.

Girls tend to work much harder in school than boys. This might stem from their low self-confidence. After a while, this difference in work attitude leads to boys relying more on their ability to think logically and girls relying more on their ability to work hard and cram. Subsequently, boys tend to develop deeper insight into exact subjects.

The failure in having learned how to study for STEM from an early age on will catch up on girls in higher grades: They will have difficulty catching up with their work.

This in turn results in girls running against the frustrating wall of 'I told you so all along, I can't do STEM, girls can't do STEM.'



Romanian teachers agree with the stereotypes depicted in the stories

The teachers realized that they should be more careful in the way they treat their pupils as the students might notice subtleties which the teachers might consider unimportant.

The workshop was successful in raising awareness on the topic (for both pupils and teachers).



Luxembourgish teachers agree with all depicted stereotypes except one

Teachers mostly agree with the stories:

'Boys are (not) better at technology': They admit that they instinctively ask questions to pupils who might know the answers. Girls are usually not in the top 3, they state.

'Women who made history': They are not surprised by the low prominence of women in STEM-textbooks. However, they don't believe a teacher would answer "No, women have never been in science".

Electro calling: They note that most of the disciplines available at their school are not attractive to girls. Furthermore, girls usually have no realistic image of STEM jobs.

However, they disagree with one story:

'The score': The teachers don't observe any difference in grading girls vs. boys



Thanks to the feedback of teachers from different countries, we see that most of them agree with the stereotypes identified by pupils.

PREPARATION MATERIAL

In this part of the booklet, you will find material to prepare your classes and activities. The aim is to create more gender-fair teaching practices and a safe study environment for girls in STEM.



WHY IMPLEMENT SEPARATE ACTIVITIES FOR GIRLS IN STEM?

Resource created by VHTO

To promote gender diversity in STEM, some knowledge institutions and organisations organise separate activities for girls and women. This often raises the question of whether or not such activities actually have a negative/stigmatizing effect. Questions such as 'Do you not send out the signal that STEM is actually something for boys and men?' or 'It is normal when a girl opts for a STEM study programme and profession, isn't it?' are questions that often arise. These are understandable questions.

In an ideal world, separate actions for girl and boys are not necessary, but in the Netherlands, we are still a long way from that. Is it 'normal' for girls to opt for a STEM study programme? Yes and no. Yes, it is normal because girls and boys get equally good marks for STEM and because there are no legal or organizational barriers for girls to opt for specific study programmes. And no, it is not (yet) normal, because there are still very few girls who choose STEM.

1. INTRODUCTION

(Research-based) interventions during moments of choice:

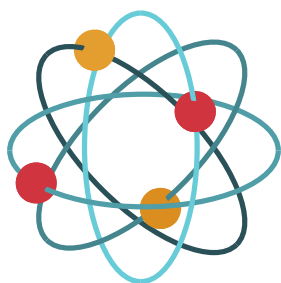
In the Netherlands, pupils have to choose an educational course (much) sooner than in most other countries. At that age, young people are still developing their identity. This makes it very difficult to make choices that will determine an important part of their lives (school career and professional career). It is even more difficult to make non-traditional choices at such an early age, such as girls who opt for STEM.

If there is a strong gender imbalance, it is important to devote explicit attention (temporarily) to this target group, for example, special information activities for girls. Microsoft research has shown that Dutch girls show little interest in STEM subjects and often drop out of science subjects as early as the age of fourteen. Reasons include the lack of female role models and a negative image of social interaction and creativity in STEM.



LEAKY PIPELINE

Unfortunately, a large group of girls who did opt for a science subject at secondary school decided not to opt for an advanced STEM programme. Despite the fact that girls achieve the same high marks in mathematics, physics, chemistry or biology as boys.



This shows that there is 'unutilised STEM talent' among women. At HAVO (Higher Secondary Education) level, 76% of boys with an N-profile choose an advanced STEM programme to only 33% of girls, at VWO level (pre-university education) there are 79% of boys with an N-profile compared to 52% of girls.



2. RECOMMENDATION

- The right approach

Increasing the participation of girls and women in STEM requires involvement and commitment at different levels and from different actors. Please note: this is about empowering girls rather than helping them. The following preconditions are important for the development of successful policy and activities.

- Chain approach

Cooperation with all relevant actors: secondary education, the STEM/technical industry and other partners (in the region).

- Integral approach

An approach on all fronts simultaneously, aimed at both the inflow of female students to beta, the retention of these female students in that field, and the successful outflow to the beta/technical labour market. Additional attention should be paid to either the inflow or the through-flow, i.e. the outflow is not effective in the longer term.

- Longitudinal approach

No one-off activities, but a solid multi-year approach (which is systematically evaluated in terms of impact and process, and, when appropriate, on an interim basis will be adjusted).

Gender-specific activities - information, events and meet-ups in which girls are among each other - are one part of this integral, longitudinal chain approach. The approach will therefore not work if these gender-specific activities are the only thing an education or organisation does, but they do have a major effect if they are accompanied within a diversity policy.

The advantages of gender-specific activities are among others:

- The use of female role models ensures that girls can identify themselves with them.
- Girls feel supported and less isolated when they are with other girls
- Organizing activities, especially for girls, creates a safe environment for girls

Organizing activities especially for girls, provides them with a safe environment in which they dare to try out STEM. Girls feel more explicitly invited than for non-gender-specific activities, because it isn't natural for girls to choose STEM. Women are still a minority in STEM. With separate activities, you prove that your organisation has an eye for this and that you do something about it.



3. SITUATION FOR GIRLS/WOMEN AND SCIENCE AND TECHNOLOGY IN THE NETHERLANDS

Strong under-representation of girls and women in STEM.

Not only in the Netherlands, but also in other countries, girls and women participate less in STEM than boys and men. However, the Netherlands occupies a special position in this respect: our country ranks low on international rankings in this field.

Nevertheless, more and more girls choose science subjects (N-profile) in secondary education and many more female students opt for STEM studies than in the past.

However, numerical studies show that the proportion of girls opting for a STEM career is many times smaller than that of boys. At important moments of choice, we see that girls and women do not opt for STEM:

- In the transition from primary to secondary education (the choice of a school where STEM is offered)
- During the profile choices in secondary education
- When choosing an advanced course (mbo, hbo and wo)
- When choosing a working environment (in industry or engineering...)

No difference in aptitude

Scientific studies show that there are no differences in terms of ability that could explain the low participation of girls in STEM. It is true that several studies state that men score better on spatial understanding ('mental rotation tests') and that these differences already occur with young babies. This seems to be related to higher levels of testosterone that boys carry in their womb. However, these 'natural differences' seem to be very small; they are greatly increased through parenting.

For example, many studies show that adults treat boys differently: boys are offered more toys that train spatial understanding, while adults prefer to let girls play with 'soft' toys such as dolls or cuddly toys. These differences in terms of spatial understanding disappear later when women undergo these tests. Moreover, studies show that the small difference in aptitude (when it comes to spatial insight) does not explain the low level of participation of women in STEM or technical professions.

The Netherlands, « leader » in gender-stereotypical associations

Based on an analysis of the data from Harvard University's Implicit Association Test it appears that more than 70% of the respondents, both men and women, implicitly associate beta with masculine and alpha/gamma with feminine, even if they think of themselves as having egalitarian views. Out of 34 nations worldwide, Dutch people have very gender-stereotypical connections: the most gender-stereotypical associations between gender and beta were found in

Tunisia, followed by, ex aequo, the Netherlands, Hungary and Romania (Nosek et al. 2009, Miller et al. 2015). The fact that this stereotypical image is strongly shared by most Dutch adults (and therefore also by parents, carers and teachers), combined with the fact that children see few female STEM professionals in their environment and the media, contributes to maintaining the persistent stereotype that STEM is a male dominated domain.

Unintentional exclusion...

Several actions have already been initiated, but there is still much to be improved. There is still unconscious and unintentional exclusion of girls and (young) women in STEM. Intensification and expansion of existing activities are needed to speed up cultural change in parenting, education and business.

Due to the limited participation of women in STEM, girls and young women have few role models in this field (Geerdink, 2011; Hill et al., 2010). Female role models can promote interest in and motivation for STEM (Broadley, 2013; Hill et al., 2010). Therefore, using role models is one of the most valuable methods to break stereotypes regarding technical studies and gender: girls can identify with them because a role model creates a sense of belonging.

MASCULINE AND FEMININE CONTENT IN STEM TEACHING

Resource created by WIDE



This short video created by WIDE aims to raise awareness about the fact that women are rarely represented in school books, especially not in science books or in history books.

It also takes the example of preparing a robotic activity. Indeed, most robots are very often in the shape of trucks.

The video emphasizes the fact that, from an early age, toys for boys are usually different than those for girls. That's why we advise teachers to do something new in robotic classes: create gender-neutral robots which can also be appealing to girls.

You will find the video on the Gender4Stem website!

TEACHING MATERIAL

In this section of the booklet, you will find examples of activities for girls and boys in STEM, such as interactive and playful programming exercises. Pupils, - both girls and boys- are usually more eager to learn programming, when practicing. The material and resources below are good examples of gender-neutral content.



TRY PROGRAMMING

Resource created by VHTO

1st part: MakeyMakey

MakeyMakey is a small device that you can connect to your computer. MakeyMakey works as a keyboard, but it is a very particular one, since it is made from clay, silver paper or bananas!

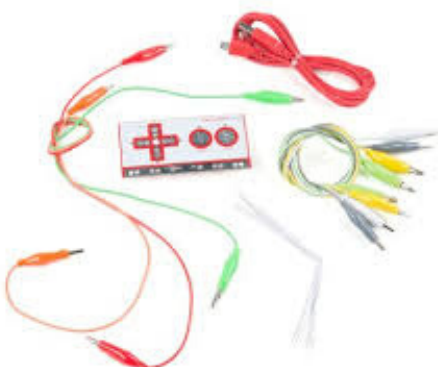
Not all the keys on your new keyboard can be used, but you can use the spacebar and the arrows, up, down, to the left and to the right. These are exactly the keys you need to play Pacman!

Before being able to play Pacman with MakeyMakey, you have to connect it to your computer. Follow the steps below to connect the MakeyMakey keyboard



- The MakeyMakey is the flat plastic plate with a number of holes in it. This plate does also have an USB connection. Stick the small side of the red wire in the USB connection. You have to plug the other side of the red wire into the computer. If you managed to connect MakeyMakey to your computer, a little red light should now be on.

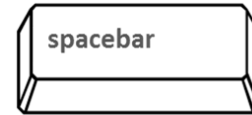
- You do not need to install MakeyMakey. If the computer asks you to allow to install the device, then press the cross in the right top



- Take one of the crocodile clamps and insert it in the two holes, under the word 'earth' on your MakeyMakey. Hold the other end of this crocodile clip when you play Pacman.

Knead a piece of clay in the shape of a space bar and paste it onto the table.

1



Insert the end of a new crocodile clip into the space bar.

2

Insert the other end of the crocodile clip in the two holes of your MakeyMakey spacebar. Now your space bar made of clay works like a real one!

3



Now knead a piece of clay in the shape of an arrow to the left. Paste this on the table near the space bar, but not against it. Attach one side of a crocodile clip to the left arrow that you made of clay and insert the other side in the two holes of the left arrow. You can now move the arrow made of clay to the left.

4

Knead a right arrow and connect it to a crocodile clip, and then connect it to the two holes on MakeyMakey

5



Use the same technique to make a led up arrow and a down arrow, both connected to the MakeyMakey.

6

Finally, you can make an enter button with the clay, and connect it to the two holes under which are written "click"

7



Pupils can now use the MakeyMakey to play Pacman! On Google, you can search for Pacman games, for example the Google Doodle Pacman. Enjoy!

2nd part: MakeyMakey and Scratch

We are now going to program a cat with Scratch and make the cat move with the keys of the MakeyMakey keyboard. Follow the steps below. Note that after the 4th step, you can follow the steps on the website.



1

Go to the website www.scratch.mit.edu



2

Click on the 'Create' tab in the top left corner. In the top left corner, a screen with a read cat will appear. In the top right corner you will see various short phrases in blue blocks, an empty field and a list of assignments.

3

Start the first command by clicking on 'Start Scratch' in the rightmost field.



4

Read the text that now appears in the right field and then click on "Begin"

Follow the steps that appear on the right side of the website and then always click on "next". You will see the light blue blocks that are at the bottom... Skip it. You don't have to click on this.

5



6



Read on and call one of the counsellors when you get to the 'Share' step. You have created a program in scratch and you have learned that a program consists of several assignments. At each step you have created a new command that the cat had to follow. When it was necessary, you adapted the assignment. So, through the programming, you are the one who determines what instructions the computer has to follow, and when. For example, you have indicated which sound has to be heard, how many steps the cat has to make or that the color of the cat has to change.

3rd part: MakeyMakey and Scratch - Assignments

You are now going to add extra tasks to your program. Before you add these to your program, you first need to think about which assignments you want the cat to do. Does the cat do a movement when you press an arrow and which movement is that? Does the appearance of the cat or the background change? Or do you hear a noise? Describe the assignments below as precisely as possible.

What does the cat do when you press the clasped left arrow?

.....

.....

What does the cat do when you press the clasped right arrow?

.....

.....

What does the cat do when you press the up arrow?

.....

.....

What does the cat do when you press the down arrow?

.....

.....

Now call one of the attendants. They will check if you can include the assignments you have designed in Scratch. If yes, then you can continue and follow the following steps in order to program the commands.

Some advice: this program is similar to the assignment in which you use the space bar.

1

Click on the sprite cat in the field below left. This is how you make sure that the commands you're going to program and give to the cat are going to be carried out.

2

Which dark brown block at 'event' do you have to drag to the right side to ensure that an assignment is carried out when you click the left arrow?

3

Drag this event to the right field where the old orders are written.

4

Select the arrow that allows you to execute the command. You can select this arrow in the block you just dragged to the right side.

5

Which block do you need for the assignment?

6

Drag and drop the 'move', 'align' or 'sound' block and attach this one to the event block.

7

Do the same for the arrows to the right, up and down.

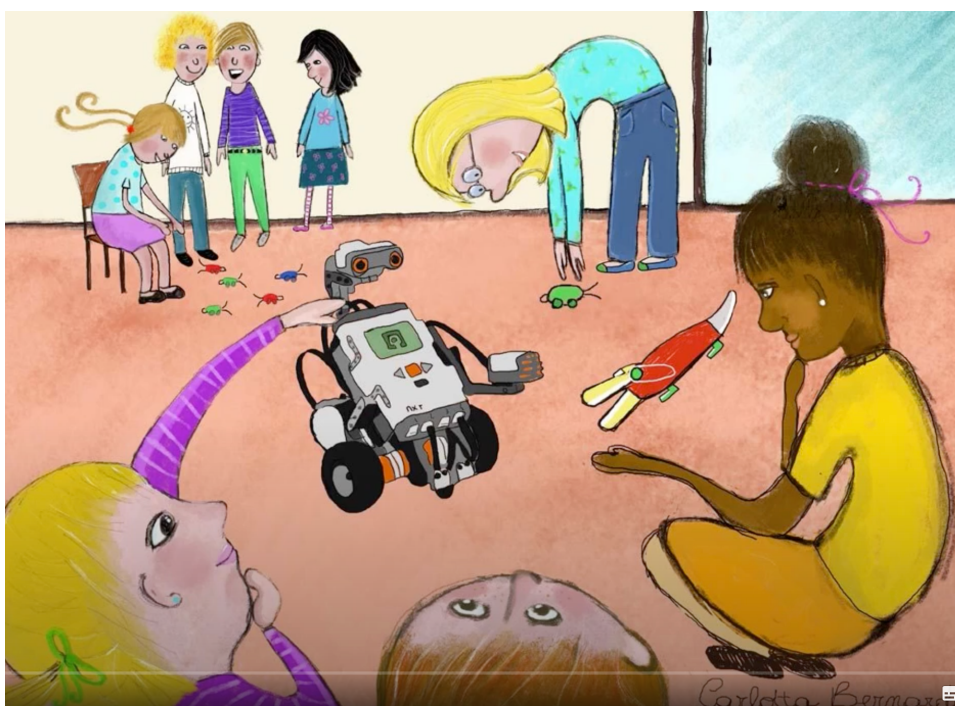


You can now test your program and make your cat dance just as you have imagined it!

HOW ROBOTICS CAN INCREASE GIRLS' INTEREST IN STEM

Resource created by Smart Venice

This video aims at providing STEM teachers with useful tips, in order to increase the interests of girls in STEM subjects, by the use of educational robotics. In the tutorial, Tullia Urschitz shares at first an overview about gender stereotypes in STEM, then talks about some European initiatives to contrast gender inequalities in this field. She gives concrete examples of teaching activities in maths and science using educational robotics. Finally, she concludes by giving some useful tips and links to resources that can be used by teachers who might want to learn more about the subject.



Introduction (01:27)

Gender stereotypes in STEM (02:21)

Some initiatives to contrast gender inequalities in STEM (09:40)

How educational robotics can help reduce the gender gap in STEM education: concrete examples of teaching activities in Maths and Sciences (17:15)

5 conclusive tips (38:17)

Useful resources (40:55)

COUNSELING MATERIAL

In this part of the booklet, you will find material that you can use to show girls that STEM are possible study options. Therefore, this material highlights various career paths guidelines. You will also find guidelines for the creation of specific activities for girls in STEM, as well as summaries of interviews with female role models in STEM. The material can also be used to discover new jobs and career opportunities for girls and boys. The objective is to encourage girls to explore their options in STEM and to avoid them getting discouraged to follow this path.



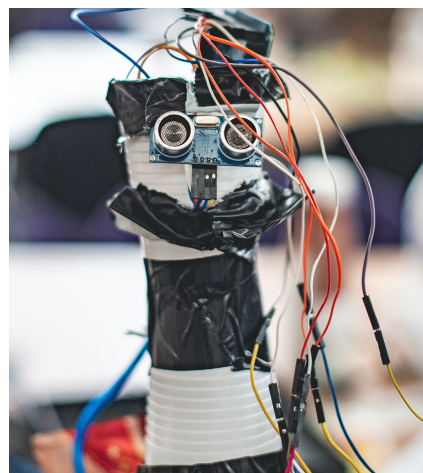
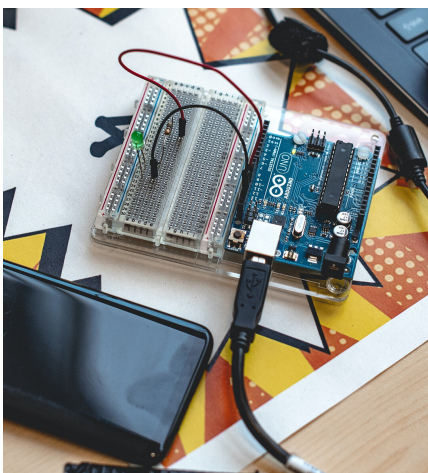
HOW TO ORGANISE A WORKSHOP HACKATHON FOR GIRLS IN STEM?

Resource created by Consulio

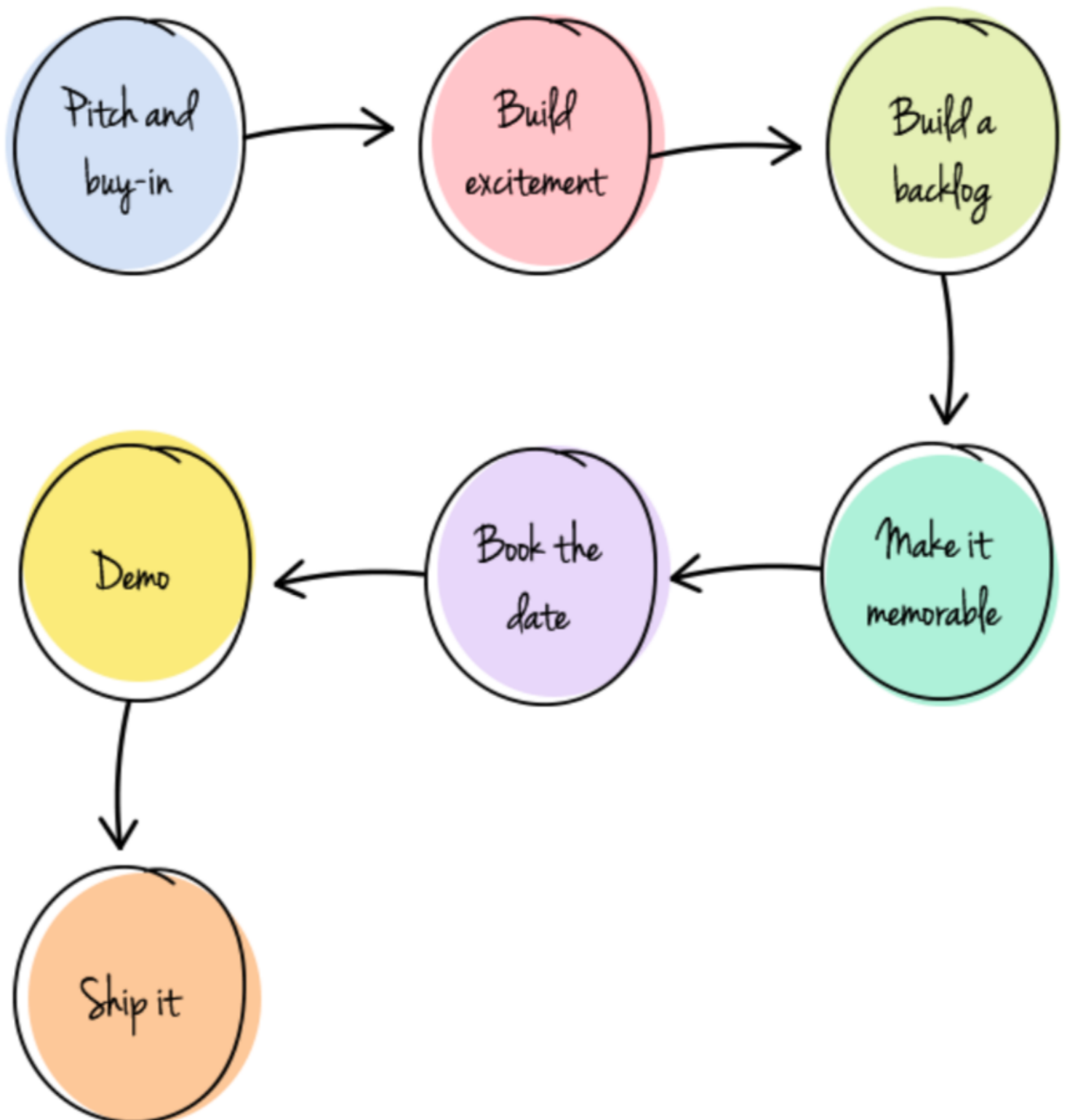
What are hackatons?

Hackathons, also known as hack days, really started to become popular in the 2000s. Hackathons are an event where Software Developers, for a defined period of time, work on topics of interest that may or may not be related to their regular work. Teachers should organize the hackaton in collaboration with a company working in a relevant field, create a partnership with the company and directly involve company's developers and experts. Directly involving a company makes it

worth talking about "product". During this event, developers usually take shortcuts and don't follow the normal processes and procedures. Projects can be undertaken by a team of developers or by an individual. Developers often choose projects that are innovative, let them explore new technologies, may be of value to the business, or simply help make their day-to-day life easier at work. Target are girls which are already able of programming at the age 15-25.



7 essential steps to organize a successful hackathon



Step 1

Pitch your hackathon and win buy-in The first step is developing a pitch slide deck. Suggestion is articulating the following points in your slide deck: □ What's a hackathon? Give a quick intro to hackathons and their variations.

● List companies that have hackdays: Include some unicorns and some renowned startups and familiar names such as Netflix, Facebook, IBM, Google, Shopify, and of course Klipfolio :)



● List world famous projects that were born from hackdays or free time given to students: Great examples are Gmail, LinkedIn's "year in review", and Shopify Stories. There are many more examples on the web that you can choose from.



● Explain why hack days are important to developers? Recognition and visibility are motivational aspects of hack days that you can leverage.



● Why are hack days important? Motivated girls are a key ingredient in the success of a hack days, they are an important part of that. Cycles of innovation, new opportunities, exploring new areas, marginal improvements, are all good reasons to have hack days



● Proposal: You should also include a one slide proposal in your deck with information like, duration, scope, frequency, and evaluation. Basically, now that you have the idea, how are you going to run it.

After presenting the pitch to the potential girls that are interested, you still have a lot of work to do, but the hardest part is done

Step 2: Build excitement

Having excited participants is probably the second-most important step. If you declare a hack day but your talented team is not into it, then the event and, obviously your initiative, fails. To build excitement among team members, we suggest the following:

- Present a modified version of the pitch slide deck, and highlight the benefits.



- Be excited yourself: Show your excitement. Use any opportunity to highlight what a big deal it is that you have opportunity to organise hackdays.

- Brainstorm: Engage people around you in a brainstorming session to come up with ideas and projects for the event.



In summary, use any opportunity to highlight the event and be clear it matters to you, show why it's important, and why it should matter to girls. This is your event and you should evangelize the heck out of it to rally your team around it.

Step 3: Build a backlog before your hackaton

You don't want your team to lose time on the day of the event figuring out what they want to work on. Therefore, we advise you to read the following guidelines

- Create a collaboration space/document (for example, a wiki page or Slack channel) at least one week before the event and start collecting ideas.



- Write your ideas down to get people excited! You can also facilitate a brainstorming session ensuring the team comes up with as many ideas as possible.

- Remember, there are no bad ideas. However, make it clear to everyone that girls are absolutely free to choose what they want to work on.

In summary, the list of ideas saves time on the day of the event, provides structure and organizes the process, ensures everyone has something to work on even if some girls have a hard time coming up with ideas themselves.

Step 4: Make your hackathon different and memorable

- You want the day to be different than a normal day. In many cases, having a budget for pizza and snacks works and participants appreciate it. You can also print posters for promotion.
- You can also think about making it an off site event if you can find a good venue.
- If you use Slack or other communication tools, create a channel for the event.



Step 5: Book the date and start preparations for your hackathon

- Choosing the right date is also crucial and the most important aspect. You will never find the perfect time, but make sure at least it's not the worst possible time for everyone.
- You can do your part by canceling team meetings and booking everyone's calendar ahead of time to make sure they don't have to go to other trainings. Then the day before the event, have a quick chat with the team, get them excited and reiterate that they should already have a project in mind.



Step 6: Book a hackathon demo meeting

- It's celebration time! Invite people to a Hackathon demo. In addition, depending on your teaching activities, you may also want to select winners chosen by a panel of judges or audience votes.



- Some organizations prefer not to have winners to avoid demoralizing the non-winners. A healthy dose of competition is always fun and can motivate! The winners could get more time to finish off their hack, receive a monetary reward, or chocolate!

Step 7: Ship it!

- While having a day to work on the topic of their choosing is very exciting for the girls, nothing motivates them as much as seeing their hacks materialize in the product. Keep in mind that if none of the hacks are productized, girls may not be as motivated the next time around. If you have done a good job of assembling the hackathon backlog and facilitating the ideation sessions, you will definitely end up with some hacks that are worth the productization effort.
- Make sure you do whatever is in your power to select at least one project and feed it into your product roadmap. This demonstrates the value of your hackday and keeps surrounding inspired and energized for the next events.

Wrapping up the hackathon

One important aspect of your job is keeping girls engaged, inspired and stoked. Hackathons are one of the many ways you can achieve this goal.

HOW TO INTRODUCE STEM ROLE MODELS IN YOUR CLASS?

Resource created by PRoF



The purpose of these Guidelines is to elaborate activities using a variety of teaching methods for a Role model meeting class. By the end of this class young participants will identify new insights in a STEM profession by taking up an active attitude.

To prepare the class for a Role model meeting, teachers will follow these phases:

- Pre-meeting activities
- After-meeting activities
- While-meeting activities



In collaborative classrooms, teachers share authority with students in very specific ways. Characteristics that derive from this agenda include in-depth learning; involving students in real-world, relevant tasks; engaging students in holistic tasks; and utilizing students' prior knowledge.

1. The pre-meeting activities

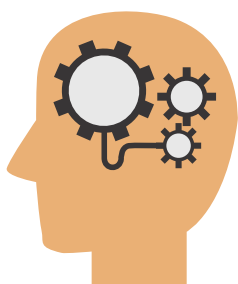
● A brainstorming (5')

The teacher will prepare students for the meeting by asking them to share what comes to mind when they think of a scientist and/or what jobs they associate with science.

Students are encouraged to speak freely and stereotypical representations of STEM jobs are likely to emerge:

man, laboratory, glasses, white coat.
(gender bias)

Teachers will ask students to prepare some questions for the Role model which will be written on post-its and stick on a Role model poster.



● Selection of the role models

Role model's profile will be selected in a way that everyone can relate to so as to avoid exclusion: it is interesting to have young role models, but the diversity of personalities and the different fields they work in (not only successful careers) are equally important.

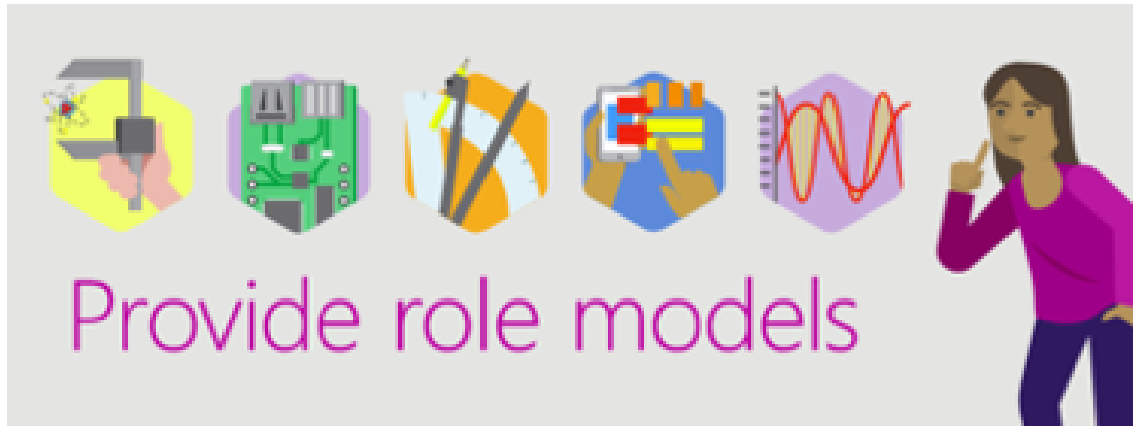
Speaker(s) can be:

- a successful student in a STEM domain,
- a young researcher,
- an engineer,
- a technician,
- any science-related job can work.



NB. If possible, choose a woman who does not work in a predominantly female field (biology, medicine). Also try to choose people who have followed non-linear paths to enhance students interest and help them understand that there are a variety of paths that lead to STEM careers.

2. While-meeting activities



● Introducing role model to the class (5')

The role model or the teacher (who becomes a facilitator) encourages all participants to speak freely and ask any questions they might have at any point in the discussion.

The speaker will explain why they are willing to meet young pupils/students (not only because they were asked to) and to exchange with them things like: name, age, the STEM discipline they choose as a career, family, hobbies and children.

A short video (no more than 3-4') can be showed to describe, for example, the speaker(s)'s field of science, work environment, relevant personal stories, or an interview concerning their career/job.

NB. This part of the activity is interesting to help students identify with the speaker ("What was he/she doing at my age?") and what they are experiencing right now.

● What comes after school? (15')

1 Presentation (5')

2 Questions (10')



Expected questions



What did you like to study?
How did you get to the job you have now?
Why did you choose this course of study?
What did you like about it?
What aspects do you use today?
If you failed at something, how did you choose another path?

● More specific questions (10')

What do you do on a daily basis?

Who are you in contact with during the day?

Who works with you?

How would you describe a typical day? (Role model can bring pictures of the work environment, of s/he working)

Do you have a social life?

If you failed at something, how did you choose another path?

Who controls/checks what you do?

Who is your boss?

Do you have one?

How is your work evaluated?

Why did you choose that career?

What do you like in this field?

Is your job innovative?

What is your role in civil society?

Students (depending on their age) will be interested in the wide range of individual experiences. It will reassure them to know that there is more than "one way".



3. After-meeting role models activities

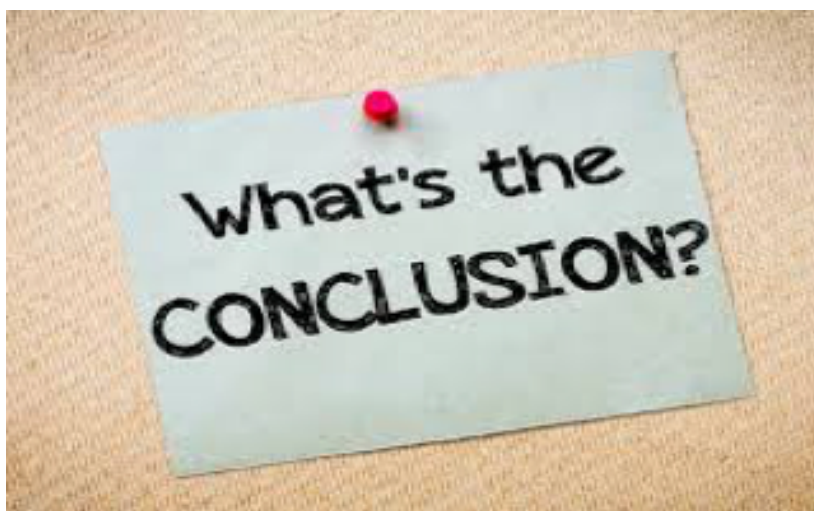
● Conclusion (10')

Students can be asked what comes to mind when they think of a scientist now that they met the speaker(s).

They can also be asked if they have ideas of the job they would like to do later and whether the activity sparked their curiosity about careers in science.

A plenary discussion at the end of the activity, gathering the teacher and students, can help bring more depth to what they heard during the activity.

The students must leave with the feeling that they are able to choose some paths in STEM, that it is a possibility for them too.



● Feedback (5')

A free written feedback will be collected on small pieces of paper as they leave the class. They will be read randomly by the students in the next class.

ROLE MODEL TESTIMONIALS

Resource created by LIST

These interviews with talented role models of women in STEM can be used as a way to raise awareness on the idea that girls do belong in STEM. This can motivate other girls to follow the same path, as they can recognize themselves in these female role models. To watch the interviews, go to our website!



1. Interview with Dr. Elisabeth John

Dr. Elisabeth John comes from Luxembourg. She holds a PhD in Biology (more specifically in genetics). She is coordinator of the Scianteens Lab, a research laboratory dedicated to teenagers at the Luxembourg Centre for Systems Biomedicine, University of Luxembourg. In 2015, she was awarded an award from the National research funds of Luxembourg for the Outstanding Promotion of Science to the Public.

During this interview she presents her background, she shares with us her motivations to involve in a STEM career, she explains how she organises her job activities with her private life and gives piece of advice to boost interest of girls in STEM disciplines.

2. Interview with Maria Corbet Nits

Maria Corbet NITS (Romania) is graduated from the Polytechnics Institute in Bucharest, the Energy Engineering Faculty. She has worked as a Heating, Ventilation, and Air conditioning designer engineer especially for pharmaceutical manufacturing plants construction. She is also administrator at her company SC EXPERT SRL.

During this interview she presents her background, she shares with us her motivations to involve in a STEM career, she explains how she organises her job activities with her private life and gives piece of advice to boost interest of girls in STEM disciplines.



Pupils can watch the video on our Gender4Stem website!





3. Interview with Daria Petca, Valeria Cagnina and Seréna Boukelmoun

Daria Petca is 17 years old. She comes from Romania. Daria studies informatics and maths. She performs in Informatics. She is the winner of the Bronze Medal for the 11th grade for Informatics at the most prestigious National Contest called "Olimpiada of Information Technology".

Valeria Cagnina is 17 years old. She comes from Italy. Valeria has been deeply engaged into robotics and technology, since she was 11 (age she built her first robot). Today she transmits her enthusiasm and passion to young people (see valeriacagnina.tech).

Then, **Séréna Boukelmoun** (from Luxembourg) has been a member of Girls in digital for a few years, where she fancies coding, creating programs and contents...

In this framework, her team who took part to the Game of Code in March 2018, won 2 special awards: NextGen by SAP and Coup de coeur for their team spirit by Lâ Baloise. In a BGL workshop she created, she was awarded for her smart fridge, which she is still working on.

In this interview, these three talented teenagers share with us their accomplishments of which they are very proud, why they are attracted by STEM disciplines, their hobbies and some pieces of advice for girls who consider STEM education.





4. Interview with Marija Bajika

Marija Bajika studied mathematics and computer science and is currently a free lance consultant in IT and product management. She also worked as a commercial career working for IBM.

As a student, Marija Bajika had interest in absolutely everything, which made it difficult for her to choose a career path. One of the things that helped her making a choice, was the fact that she was born in Ex-Yougoslavia. At the age of 15, she promised herself that she would do a job in which she could be totally independent, not relying on politics or geography.

Marija Bajika is also a tutor in project management and she volunteers in universities. She meets with quite a lot of students. The advice she gives them is : "really think hard about what you are good at. And if that is something that has to do with numbers, with perseverance of finding out why certain things are the way they are, go for it".



DIGITAL GIRLS SUMMER SCHOOL

Resource created by Smart Venice

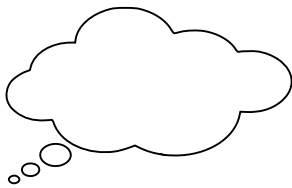
The present guidelines have been thought to serve as help for teachers and school managers of upper secondary schools to set up a summer camp, by providing indicative steps to take when adapting this good practice to their own contexts.



1. *Digital summer goals*

The main goal of the “Digital Girls Summer Camp” is to provide female pupils of low secondary schools with the opportunity to frame computer science in its true light, to experiment some technologies and participate in talks with young girls engaged in computer studies, in order to allow them to evaluate in a well-informed way their own ability and inclination to undertake studies and professional paths in computer science. During the summer camp, the girls will:

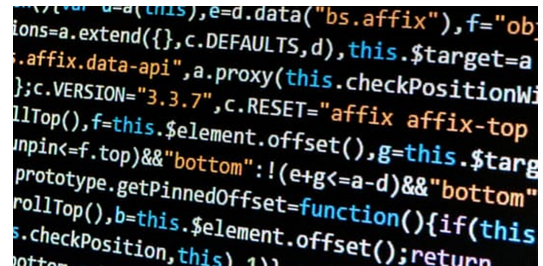
1. get familiar with creative computational thinking by way of a learn-by-doing approach;



3. work in team in order to develop a project with Arduino (an open-source electronic prototyping platform) for understanding the fundamental concepts of making, robotics and its typical components.



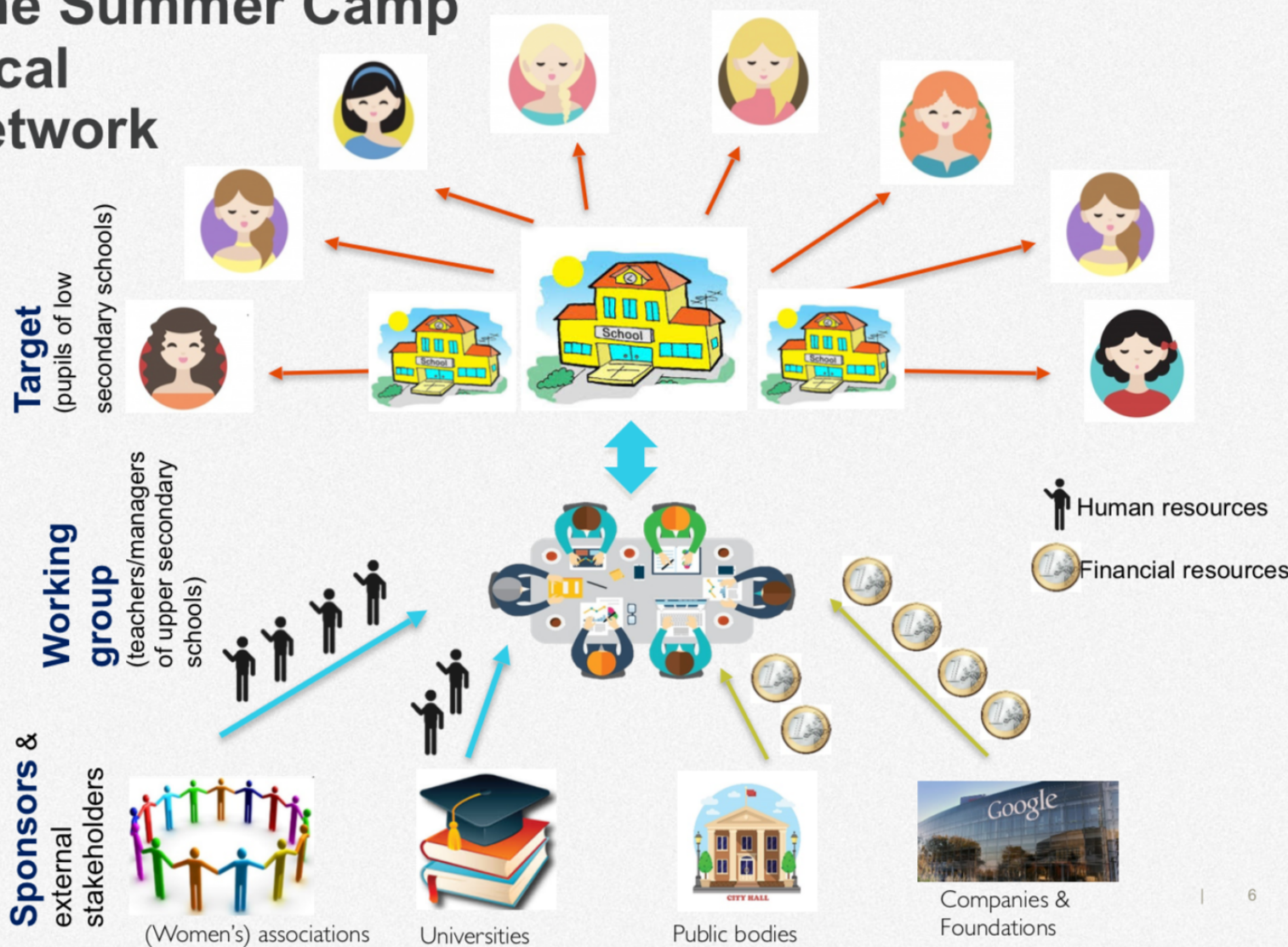
2. learn the basis of programming using different technologies, becoming aware users



4. Attend to meetings with young girls already studying and/or working in the IT world (upper secondary school pupils, university students, young start- uppers) who share their experience and convey concrete examples of how "we can do it" without hiding personal obstacles that a girl must overcome. Girls will become independent in designing and realizing simple projects. In particular, they will learn in an amusing way how to assemble a robot and how to programme its functions. The summer camp also aims at helping girls to develop team work and problem solving skills.

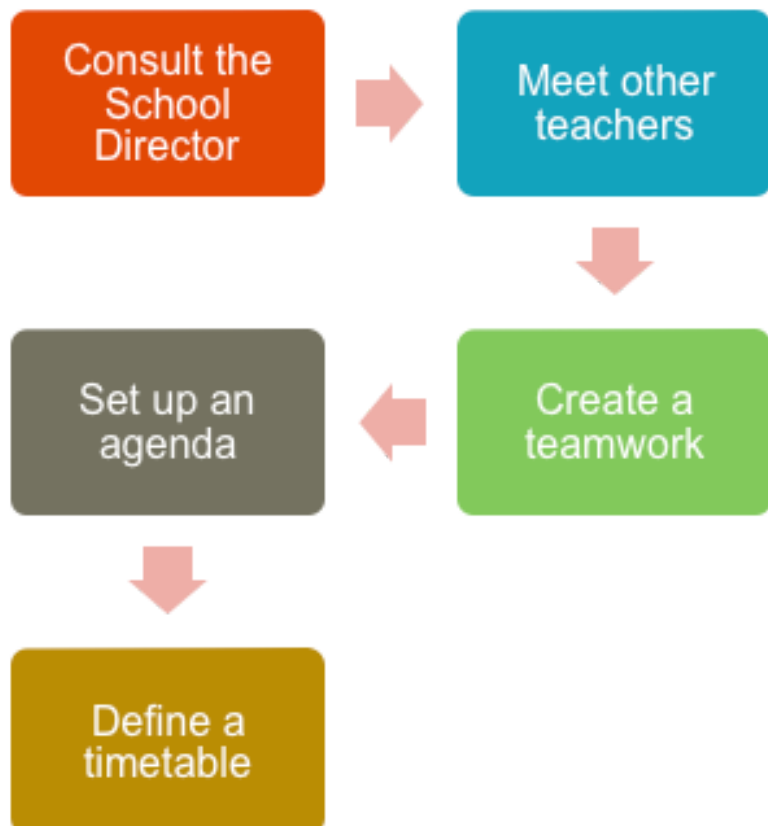
2. The summer camp local network

The Summer Camp local network



3. Create the Summer Camp working group

The organization of a summer camp cannot be carried out by a single teacher, but needs the creation of a workgroup, that can be started as the initiative of a single teacher or a group of teachers, with support from their own school manager(s) .



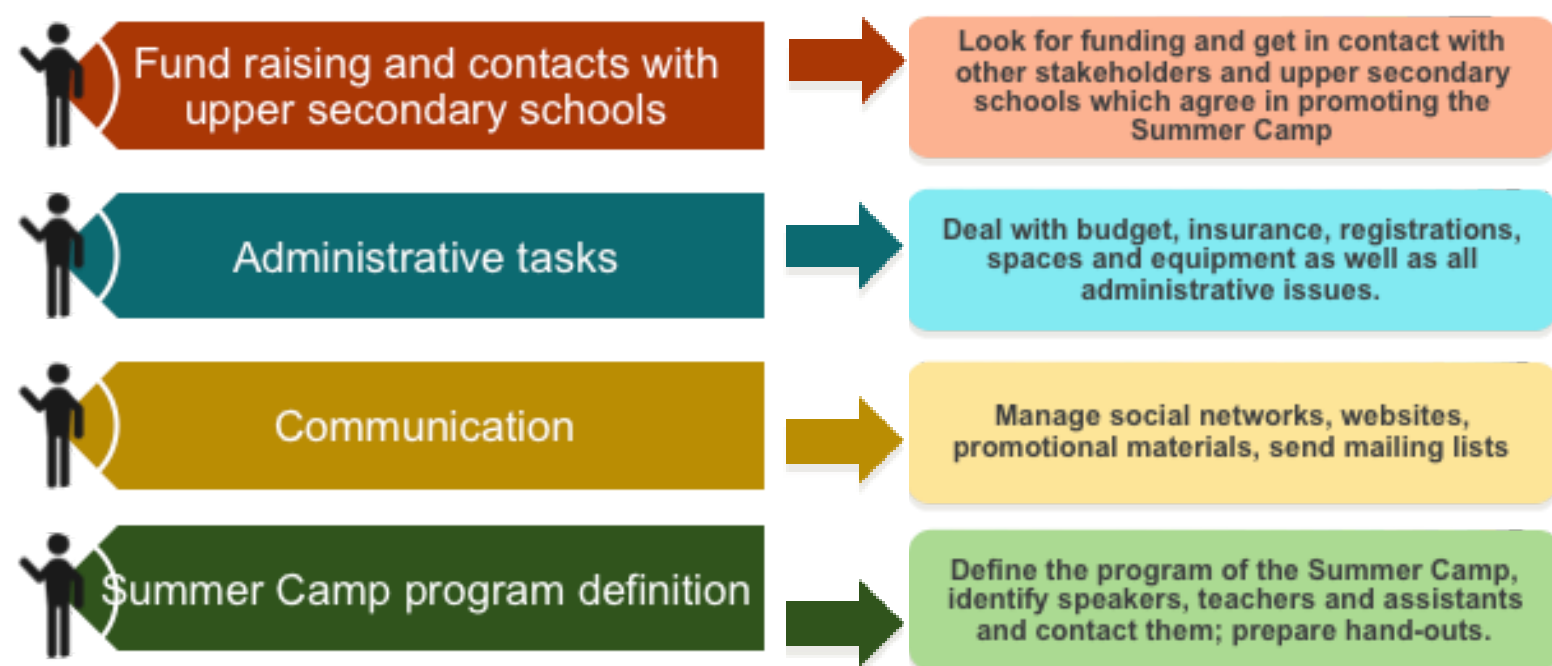
Steps to undertake:

- Consultation with the school's manager(s)
- Organization of a meeting with other school's teachers, especially those teaching computer science and other STEM subjects, in order to understand their availability to join the project
- Creation of a teamwork
- Setting up of an agenda of weekly or bi-monthly meetings in order to organize the summer camp
- Definition of a timetable



3. Create the Summer Camp working group

Structure of the working group



According to the experience of the Summer camp “Ragazze Digitali”, the working group should involve at least 4 people, working less than part time at the organization of the Summer Camp. In particular, at least one person should be appointed to one of the following tasks:

3. Create the Summer Camp working group

Definition of a timetable



Activities for the organization of the Summer Camp, according to the «Ragazze Digitali» experience, should start at least 4/5 months before the beginning of the Summer Camp.

4. Define the programme of the summer camp

Target

Target of the summer camp are low secondary school girls. In particular, it is suggested to involve pupils attending the second year at the low secondary school. In fact, this would allow them to get in contact with the world of programming, understand if they like it, and eventually decide to enroll in the school the following year.



While designing the summer camp programme, teachers need to consider which is girls' background (if any) about IT and programming. For such purpose, they shall be aware of the official school programme, provided by each National Education Ministry.

Regarding the number of pupils to involve, it is suggested to involve up to 30 pupils, to foster interactivity in a relatively small group.



4. Define the program of the summer camp

Structure

It is suggested to divide girls in subgroups of 4/5 girls with each group programming its own robot.

The age of pupils (12 years old) must be taken into consideration in defining the programme: it is advised to avoid lots of frontal lessons and try to make it as soft and interactive as possible. This is why a practical focus on automation/robotics is suggested.

Schedule the Summer Camp over 5 full time days per week, along 2 weeks.



2 WEEKS



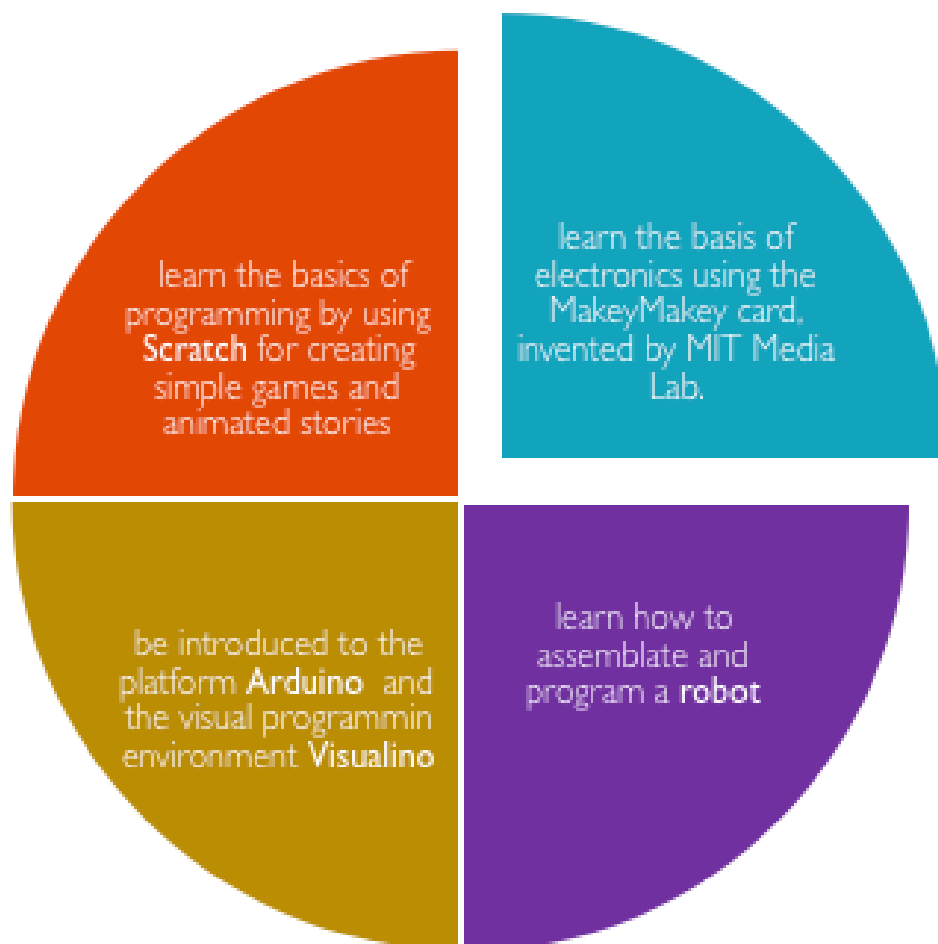
1° Week
Introduction to
programming

2° Week
Program a
robot

Concerning the specific structure teachers can give to the Summer Camp, it is suggested to articulate it in two phases, one of which lasting one week.

4. Define the programme of the summer camp

Learning objectives



Girls should also learn to plan activities, to subdivide tasks, to take on a role within the group and to manage their own time, setting goals and times for achieving the objectives themselves.

Girls will also learn to collaborate in a group having a common project, to express their own opinions, to propose solutions and to take decisions.

4. Define the programme of the Summer Camp

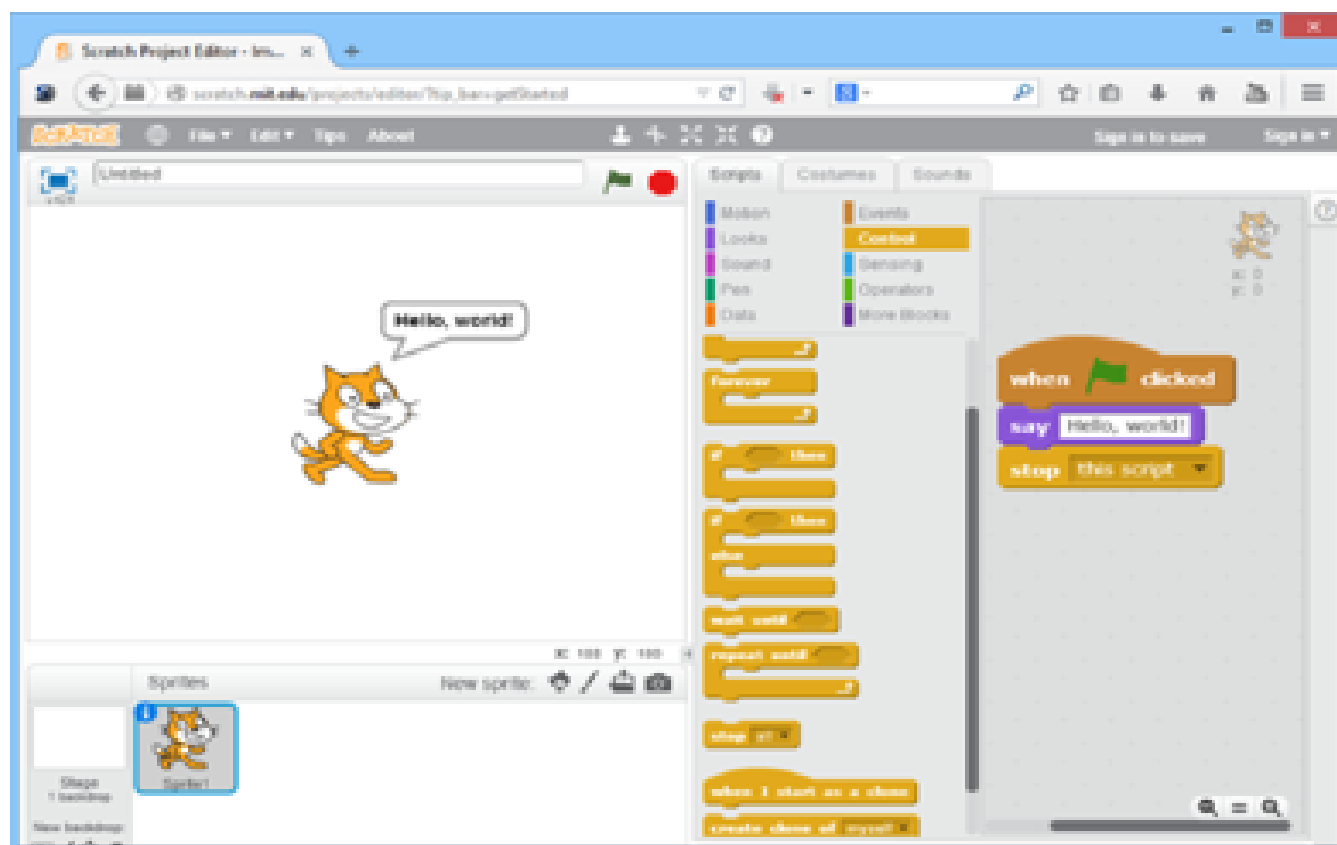
Themes

a. Introduction to programming

In the first part of the Summer Camp, girls will be introduced to programming using the Scratch platform (<https://scratch.mit.edu/>), in order to create simple games and animated stories

The platform, developed by MIT, allows to learn the basis of the computational thinking, by using an easy and engaging interface.

Learning computational thinking is essential in a reality getting more and more shaped by new technologies



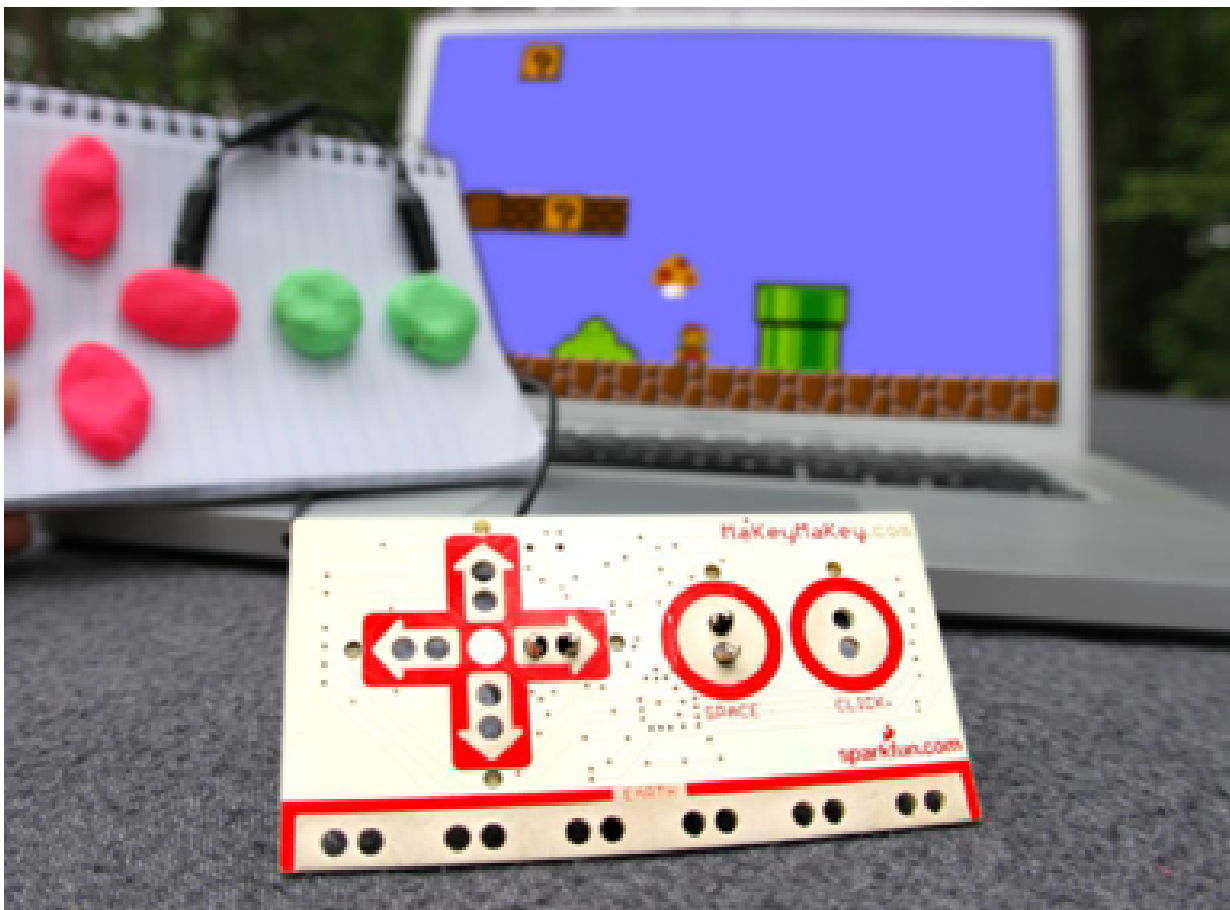
4. Define the programme of the Summer Camp

Themes

b. ntroductions to foundations of Making

In this phase girls will learn the basis of electronics thanks to the MakeyMakey (<https://makeymakey.com/>) card, another MIT Media Lab creation.

With this card girls can transform any conductive material in an input for the pc and learn in a creative and amusing way the basic rudiments of making.



4. Define the programme of the Summer Camp

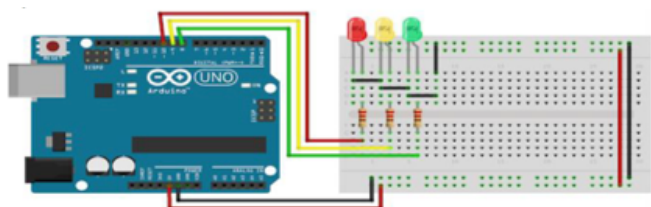
Themes

c. Introductions to Arduino and Visualino

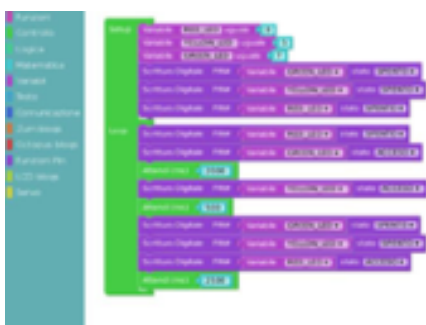
After approaching Scratch and MakeyMakey, girls will be introduced to the open-source electronic prototyping platform Arduino (www.arduino.cc) and to the multiplatform visual programming environment Visualino (www.visualino.net). Arduino permits to program using the same intuitive approach as Scratch, by using drag-and-drop logic blocks.

Visualino

Arduino



For teaching electronics and control rudiments through Arduino, it is suggested to create simple circuits with colorful LEDs and buttons. In this section, a learn-by-doing approach allows to directly experiment the acquired competences.



4. Define the programme of the Summer Camp

Themes

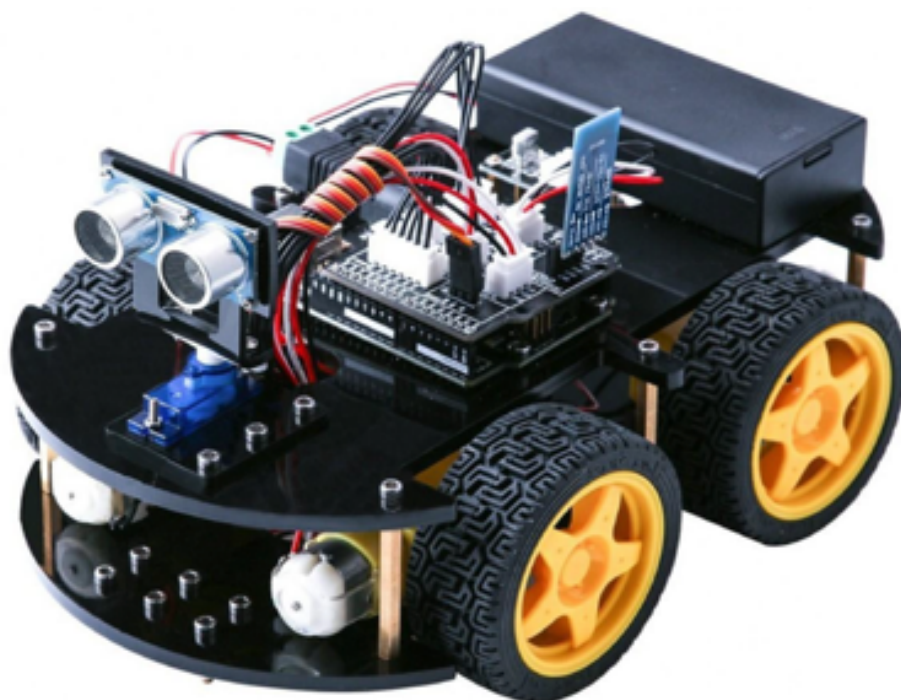
d. Learning the assembly of a robot

Girls enter in the heart of the project during the assembly phase. They learn how to assemble the components of a machine in order to obtain the robot.

After that they will be ready to start programming it.

**Assembling
robots**

1°
Week



4. Define the programme of the Summer Camp

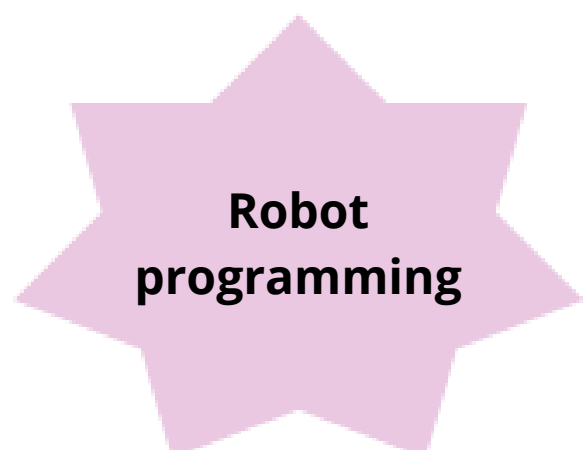
Themes

e. Learning how to program a robot

This activity represents the core of the Summer Camp and should involve a whole week. Girls will be guided in the creation of the different functionalities of the machine, starting with the basic ones, till the most advanced.

In details, the machine programming is divided in the following phases:

- Basic movements: programming of the basic movements of the machine; by exploiting the different electric engines of the machine girls should codify the different movement functions
- Obstacles survey: thanks to the ultrasound sensor and the servomotor, girls can write their function of environment exploration; in this way the machine will be able to automatically detect possible obstacles and avoid them
- Line-follow: the machine is equipped with 3 infra-red sensors able to detect the presence of a path / line on a homogeneous surface. In this part girls will first have to program the machine to follow a line and, then, create more and more complex paths and test the limits of the created functions
- Bluetooth command: programming the machine to receive the Bluetooth commands in order to be remotely controlled. Furthermore, it will be possible to combine the previously developed features into a single function for remote control
- Competition: at the end of the activities the different groups will compete with the aim of showing the obtained results.



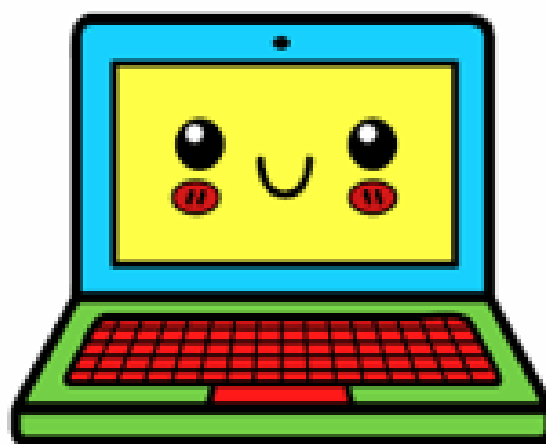
4. Define the programme of the Summer Camp

Logistics and equipment

Spaces are a fundamental point to be discussed by the workgroup, which will need to decide where the summer camp will be carried out. This choice would mainly depend on logistic factors, such as the availability of the necessary equipment.

The summer camp can be carried out either at the upper secondary school premises or at a low secondary school. In the latter option, such opportunity must be investigated with the Directors of the selected low secondary school which will be involved in the project.

In both cases spaces need to be adequate to host a group of around 30 girls and provide a computer per each participant, as well as Internet connection. In case, the option of one pc per two pupils can be considered.



In fact, one of the objectives of the initiative is making each girl fully involved in the project: for this reason it is necessary that each of them has a pc at disposal, in order to directly experiment activities.

Each computer needs to be equipped with:

- Linux environment (if feasible, otherwise Windows is also ok)
- Arduino Kit
- Visualino (C language)

It is also necessary to provide a kit for the creation of the robot machine for each group. In addition, according to the different teachers'/tutors' needs, also a projector or other equipment can be necessary.

4. Define the programme of the Summer Camp

Example of programme

Please find below the program of the Digital Girl Summer Camp organized in the frame of the project "Ragazze Digitali" and carried out in Reggio Emilia from the 9th to the 20th of July.



Day	Timetable	Activity
Monday	9 am – 1 pm	Launch of the Summer Camp
	2 pm – 4 pm	Introduction to programming with SCRATCH
Tuesday	9 am – 1 pm	Introduction to programming with SCRATCH
	2 pm – 4 pm	Introduction to Arduino
Wednesday	9 am – 1 pm	Introduction to Arduino and creation of simple circuits
	2 pm – 4 pm	Meeting with role models
Thursday	9 am – 1 pm	Assembling the first component of the robot
	2 pm – 4 pm	Meeting with role models
Friday	9 am – 1 pm	Finalizing the robot's assembling

4. Define the programme of the Summer Camp

Example of programme



Day	Timetable	Activity
Monday	9 am – 1 pm	Robot programming: the movement
	2 pm – 4 pm	Robot programming: ultrasound sensor
Tuesday	9 am – 1 pm	Robot programming: introduction to the Bluetooth module
	2 pm – 4 pm	Meeting with role model
Wednesday	9 am – 1 pm	Robot programming: controlling the machine from a smartphone
	2 pm – 4 pm	Meeting with role model
Thursday	9 am – 1 pm	Robot programming: the line sensors
	2 pm – 4 pm	Functioning checks and activity closing
Friday	9 am – 1 pm	Competition and closing day

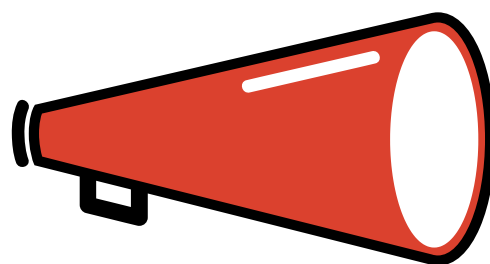
6. Organize a local promotional campaign to raise awareness and recruit girls

It is important to promote the Summer Camp in order to recruit girls, especially when the Summer Camp is organized for the first time.

A local raising awareness campaign is useful to motivate girls (and their parents) and spread the message that ICT can be fun, interesting and creative. The promotional campaign can consist in a series of activities:

- Promotional events
- Offline campaign
- Online campaign
- Promotional events

The events are carried out by teachers organizing the Summer Camp but role models can be involved.



The events can be carried out:

- at low secondary schools premises, in case the place is familiar to girls and it can be reached easily. Summer Camp promoters can present the initiative during a normal lesson based on previous agreements with low secondary school teachers;
- at upper secondary schools premises or in other locations (municipality, chamber of commerce, university) in the frame of bigger events. Also in this case, promoters need to get in contact with low secondary schools teachers and invite them to the event. This type of arrangement proved to be successful during the “Ragazze Digitali” experience.
- In both cases the event is suggested to be as much interactive as possible and to last 2 hours max: it would include presenting the Camp and its programme, having one or more role models as speakers and a final Q&A session open to participants.

6. Organize a local promotional campaign to raise awareness and recruit girls

Offline campaign

The offline campaign consists in the preparation and dissemination of promotional materials (leaflets, brochures) which present the Summer Camp and provide contacts where to receive additional information about it. The materials should also transmit some raising awareness messages.

Leaflets can be prepared for disseminating the promotional events too.



Online campaign



Promoting the Summer Camp through the Web is an important part of the promotional campaign. In particular, information about the initiative should be spread through the schools websites and social media pages, as well as through the pages of the involved low secondary schools and other education related website or social media channels.

The same materials created for the offline campaign can be used in digital formats for the online one.

7. Define the budget

The organization of a summer camp requires financial resources which might vary according to different factors, for instance the country where the summer camp is organized, the number of participants and the availability of free spaces.

In the present guidelines we consider that spaces are at disposal for free and that no fees are asked to girls, except for a small amount for covering the insurance fees. In the case of the Italian Summer Camp "Ragazze Digitali" the insurance fee is of 4 euro per girl.

Here below teachers can find a list of expenditure items to take into consideration while organizing the summer camp.



Promotional activities

As already mentioned in section 6, the Summer Camp can be promoted through a local promotional campaign, consisting in a series of events, offline and online dissemination.

The realization of the mentioned promotional activities requires to take in account some costs related, for instance, to the creation of materials (digital or paper), such as brochures, flyers, etc., but also related to the reimbursement of costs that teachers or other speakers incur by taking part to the events.

Expenditure items
Promotional materials design and printing (leaflet/brochure)
Website maintenance and update
Online campaigns (e.g. facebook promotional campaigns)
Reimbursements for participation to events

7. Define the budget

Teaching activities and laboratories

As concerns the teachers/tutors and assistants, it is suggested to pay them, on the basis of the hours of lessons given during the Summer Camp. The payment of teachers/tutors and assistants depends on the fees applied in each country (PM rate) and of course on the expertise of the person.

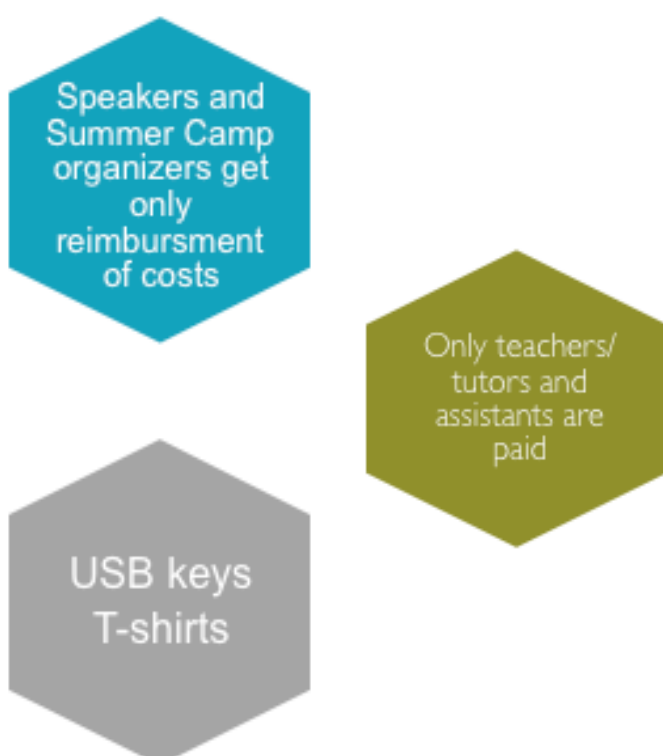
Regarding speakers, instead, it suggested to provide them only with a reimbursement of costs. The same applies to the Summer Camp organizers (the working group).

Other costs connected to the teaching activities and laboratories are the ones related to the equipment, in particular the costs for PCs rental in case there are not available for free, the Arduino kits and the robot kits.

Expenditure items
Payment to teachers/tutors and assistants
Reimbursment to speakers and summer camp organizers (working group)
Kit Arduino
Kit for the creation of the machine
PC rental

Hand-outs and gadgets

All the material is suggested to be provided digitally through an USB key. Costs for a “summer camp” t-shirt to give to all the participants can be foreseen, in case financial resources are available.



Expenditure items
USB pens
T-shirts

7. Define the budget

Opening and closing days

The summer camp can foresee an opening and a closing day in which also parents are invited.

During the opening day girls and their families are welcomed and teachers introduce themselves as well as the Summer Camp, by explaining the program in details.

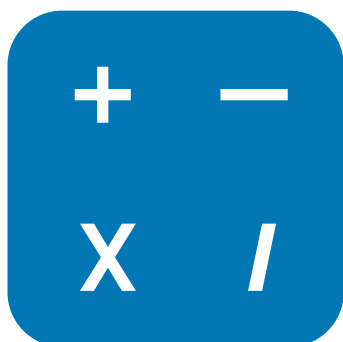
During the closing day the outcome of the Summer Camp are presented to the families.

For both days some costs for food & beverage and for a professional photographer can be foreseen, according to the available financial resources.



Administrative expenses

In the case the administrative tasks are carried out by the working group for free, the organization of the Summer Camp entails only a few administrative costs, such as bank transfers costs and insurance fees (to be paid by the girls).



7. Define the budget

How to find sponsors

In case the school cannot count on available financial resources and since no participation fees are asked to girls, it can result important to find sponsors in order to collect all the financial resources necessary to carry out the Summer Camp.

Suitable sponsors to contact can be:

- Universities
- Software companies
- Foundations
- Public bodies (e.g. Municipalities)

In the case of the initiative “Ragazze Digitali” the Municipality of Modena and two foundations provided funds directly to the University and to the Association European Women’s Management Development International Network (EWMD) for the organization of the Summer Camp.

The mentioned entities can provided not only with financial resources but also with human resources (teachers) or other type of support.



8. Evaluating the summer camp

It is important to receive a feedback from the girls participating to the summer camp. Therefore a questionnaire can be disseminated during the last days.

In general, while evaluating the experience, the following indicators need to be taken into consideration:

- Number of girls who would repeat the experience
- Number of girls that would like to enroll in schools with technology curricula
- Number of girls who feel they learnt new things during the Summer Camp

In addition, the Summer Camp working group could consider useful to contact girls also afterwards, for instance one year after, in order to have an overview about how many girls decided to enroll to schools with a technology curricula and how much the Summer Camp they attended contributed to their choice.



9. Useful tips

In case arguments are raised against the exclusion of boys from this initiative, evidence of the extremely low representation of girls from ICT studies should be used (e.g. number of male pupils studying computer science compared to the number of female pupils)



RAISING AWARENESS MATERIAL

In this section of the booklet, you will find material created to raise awareness about women in STEM, the difficulties they encounter and the support they need to choose this particular path of studies.



I WANT TO BE AN ASTRONAUT

Resource created by VHTO

This short video created by VHTO raises awareness about the lack of female role models in STEM. It highlights the idea that in most countries all over Europe the role of women is traditional: they are supposed to take care of their children and of their family, so this makes them the main care-taker of their family. Therefore, when we think of a job that girls should do, the first thing that comes in mind are jobs linked with caring positions such as elementary school teachers or hospital nurses. People think much less of jobs in STEM.

This can be explained by the fact that there are no female role models with whom girls can identify themselves.

Girls get the feeling that they do not belong in STEM. The video then provides us with Jessica's personal story, a girl from the Netherlands who wants to become an astronaut. When she shares this with Willem, he tells her that girls can not become astronauts. A few years later, Willem is shocked to see Jessica on TV. She is the first woman on the moon. The story of Jessica proves that women do indeed belong in STEM!

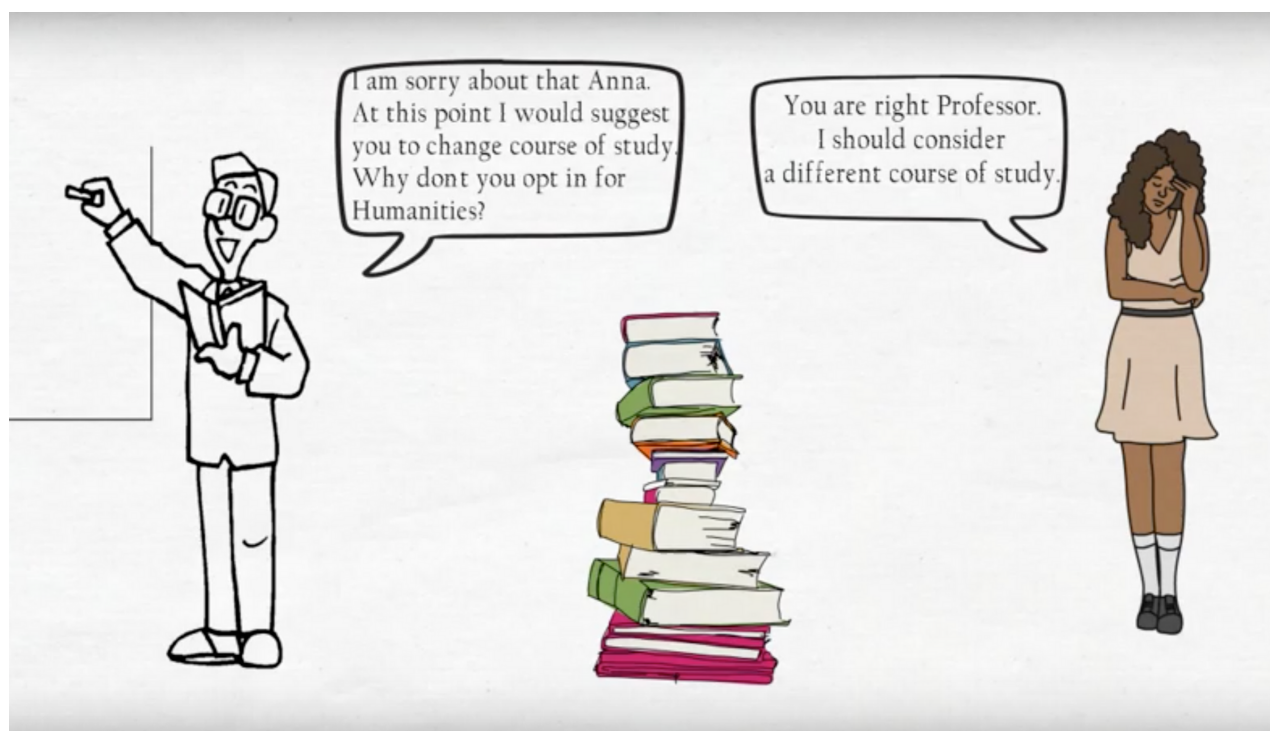
To watch the video, or to use it during a class, visit our Gender4Stem Website!

LACK OF FEMALE ROLE MODELS



WHAT TO DO NOW?

Resource created by Smart Venice



This short video created by Smart Venice relates the story of Anna. She is a girl who studies computer science at University. Anna took her first exam in analysis but she didn't pass it. Her teacher suggests her to change course of study, and to opt for something else, like Humanities. Anna decides to ask a friend for advice. Her friend tells her that her professor is right, that she should study humanities since there are even better job opportunities for girls in that field.

But Anna finally decides that this first failure won't stop her! That's why she tells her professor that she will keep on studying computer science. The moral of this short story is that girls should never give up their dreams and teachers should support them in facing new challenges! This video is thus interesting for teachers who want to raise awareness on difficulties and stereotypes that girls might face when they choose a course of study that isn't usually chosen by girls. **You can watch the video on our Website.**

WOMEN IN STEM, THE MOVIES

Resource created by Smart Venice

Movies are also an interesting way of raising awareness on gender stereotypes in STEM and to introduce inspirational role models for girls. That's why Smart Venice has created a list of movies which tackle this subject in an original way.

1

Hidden Figures tells the story of Katherine Johnson, Dorothy Morgan and Mary Jackson: they are four African American women working at nasa as mathematicians.



Ghostbusters is a comedy which features four amazing female comedians. 3 of them are in scientific roles : 2 as physicists and one as experimental engineer

2

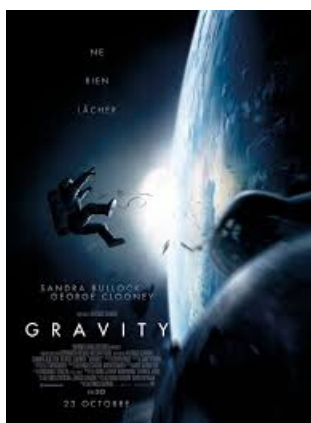
3

Big Dream is a documentary. It shares with us the story of seven young women who are breaking barriers and overcoming personal challenges to follow their passion in science, math, engineering and computing



4

Dream big: engineering our world is a documentary about how engineers are responsible for important technological innovations that drive us into the future. It highlights engineers from different backgrounds, mostly women, working on several projects such as building earthquake-proof structures.

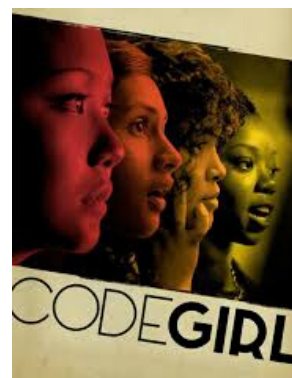


Gravity is a drama movie. Doctor Rainer Stone is a biomedical engineer. She embarks on her first mission to space to help service the device.

5

6

Codegirl is a documentary about high school age girls who try to gather their community through collaboration and technology. It wants to inspire more girls to follow their interest in STEM and entrepreneurship

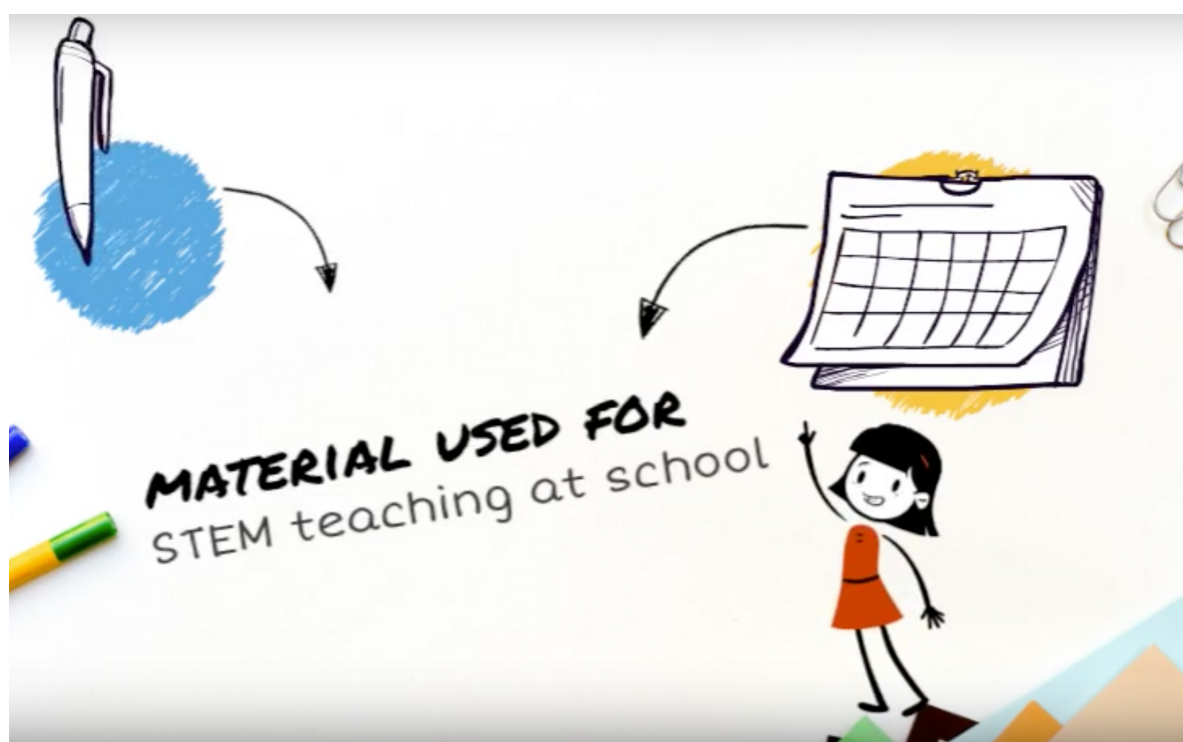


Code: debugging the gender gap is a documentary. It insists on the lack of women and minorities in the field of software engineering. It presents several successful women in computer programming. It shows that computing science can be lucrative, rewarding and creative.

7

IT ALL STARTED IN THE COMPUTER SCIENCE LAB

Resource created by WIDE



The Video “It all started in the computer lab” created by WIDE insists on the idea that there are not enough women IT entrepreneurs. Indeed, Skype, Microsoft, Google and Facebook have all been created by men. Out of the 10 most used web and mobile applications in the world, none have been created by women. It all started in the computer science club: Mark Zuckerberg, Bill Gates all went to computer science club, which are a no girls zone.

A girl would not feel welcome or well at ease there, since they feel not represented. The video also highlights another important issue : girls are a minority in computer science studies and have therefore less chance of becoming the creators of new technologies. That's why the video advices schools/teachers to make computer science clubs a place where girls feel welcome and represented as well.

POSITIVE ACTIONS FOR GIRLS IN MIXED EDUCATION

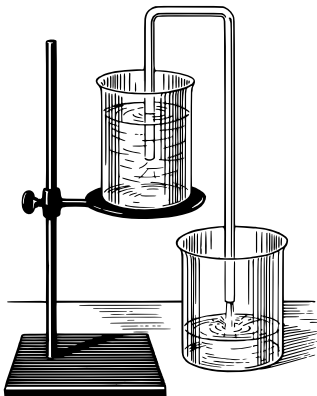
Resource created by WIDE

To encourage gender diversity in STEM, several organisations and schools choose to implement girls only activities. They are sometimes asked: "Don't such activities actually have a stigmatizing effect on the girls giving them the feeling that it is not normal to follow STEM as a girl? "Isn't this unfair for the boys who would also like to participate in an exciting STEM activity?" Of course, these concerns are understandable. Through these guidelines, we will provide some possible answers.

1/ Why organise girls only activities ?

There are certain benefits in organizing girls only STEM-activities:

- Girls feel explicitly invited to take part in STEM activities (they might not have considered it otherwise).
- Girls can identify with female role models who have a job in STEM.
- Girls feel supported and less isolated when they are with other girls that have similar (non-stereotypical) interests.
- A secure space in which girls can try out STEM is created



2/ Can't this convey the idea that it is "strange" for a girl to do STEM? Isn't it common to choose a STEM career?

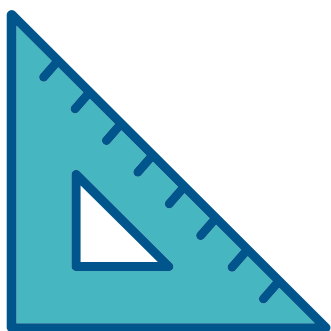
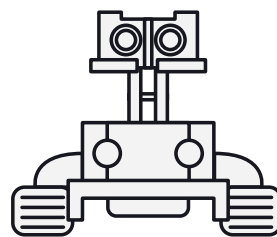
In an ideal world, we would not need to separate activities for girls and STEM. Unfortunately, this is not the reality. The low numbers of girls choosing a career in STEM are proof that we are not there yet. Yes, it is normal for a girl to follow a career path in STEM - since girls have at least equally good grades for STEM as boys, but it is not normal enough yet, looking at the lack of female STEM role models. Girls only activities can be embedded in the curriculum together with other mixed-gender STEM activities. Together these activities have a strong effect

3/ Isn't it unfair for boys not being able to participate ? Isn't it just another form of discrimination ?

Our society and economy also needs boys with a sound education in STEM.

However, boys don't need to be empowered as much as girl to do STEM. At the moment, STEM remains a much more common choice for boys.

Thus, Schools should still offer other types of career counselling activities addressed to boys and girls.



4/ Won't some girls feel forced me into STEM if I am not interested

Make sure to emphasize that the most important goal is to make sure a girl considers all her options and finds the career that really fits her interests, ambitions and abilities.

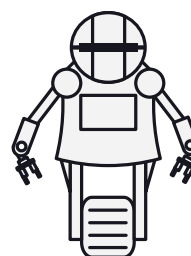
Explain that is not about choosing STEM but about making the right choice, overcoming stereotypes associated with jobs and careers.

5/ What will the boys do in the meantime ? What if boys want to join ?

Girls activities could be scheduled during 'career counselling' slots; the boys will get different counselling sessions in parallel. Boys could partake in activities on topics that they have only been exposed too little so far, like information on the social, education and care sector.

They could also do their homework or get extra study time, or be free to improve skills and gain more knowledge on certain topics.

If boys show interest in the activity: you need to set a policy of this, some organisations accept to have them to promote mixity, other organisations have stricter views on this. Anyway, you can always say that priority is given to girls: in many cases you will see that there will be enough interest from girls to have the activities fully booked.



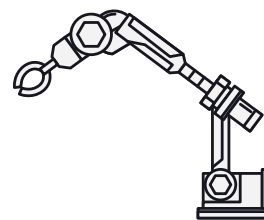
6/ How to implement girls only activities ?

It is important to decide if you want to make the activities optional or compulsory.

You could let girls free to sign up or select them based on their knowledge or interest.

If the number of pupils in the class is not an issue, let all girls partake in these activities. Some girls might be less interested. But this is actually a good thing, because you can show to especially these girls that STEM is much more interesting than they thought

You can organize your own activities (see below for inspiration) or you can work with local organizations.



7/ What kind of activities could we organize for girls only?

Career counselling activities:

- presentations by professionals on their career/company
- discussion sessions
- "speed-dating" with female STEM professionals

Knowledge activities:

- coding events
- challenges on innovation in STEM (work on a STEM topic for a whole day)
- maths/physics/engineering/... competitions
- Field trips
- to visit a technical universities/a STEM faculty
- to technology companies
- to a STEM research facility



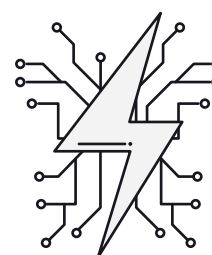
8/ What if there are strong reactions such as:

"There is no difference between girls and boys!"

"When will you do it for boys?"

Young boys and girls could also be skeptical. They might have little knowledge about gender equality topics and take equality as something for granted, especially in the E.U.

Boys might not understand why "for girls only", they feel frustrated not to access the opportunity or make jokes about this...



You can always remind them that:

- If we don't do it for girls only, there is a strong chance they won't join
- It also raises awareness for boys and mixity in general
- It's needed to inform girls on opportunities they clearly don't consider: just look at the statistics of girls in STEM
- Organisation experienced in doing this can clearly demonstrate an impact
- Girls enjoy doing activities together: they don't feel judged as girls.

So, in order to answer these possible arguments we suggest to:

Use a rationale:

- Back up with data, statistics.
- Ask why such a low number of girls in STEM classes especially the most technical section (IT, electronics ...)?

The European Commission is encouraging this: we should have more girls in STEM and design policies on this topic

The experience shows that girls are feeling more confident to embrace STEM studies after joining these kind of activities.

Getting more girls into STEM is an additional way to attract more young people in STEM. Many national policies promote STEM to young people.

Be a challenger!

Getting more girls in STEM is a clear way to get more students in these fields.

There are strong stereotypes preventing girls to pursue studies in STEM and they exist everywhere in society.

Parents do not always encourage girls to choose STEM as they don't see women being visible in the STEM world. Few role models are available either in the close environment of pupils or in the media.

Or launch the debate :

- Is there any reason for girls to be absent from several disciplines such as STEM ?
- Wouldn't some classes would benefit from more diversity ?
- Studies show that girls and boys have the same abilities to learn.
- Can we do better in the way we teach science to boys and girls ?

You will be very surprised about the outcomes of discussions and see that people, including teachers might never have had the chance to really think about this, let alone act.

OTHER USEFUL RESOURCES

In this part of the booklet, you will find other useful material which can be used to create more gender-fair teaching practices.



GLOSSARY

[STAY CONNECTED](#) [f](#) [CONTACT US](#)[ABOUT](#) ▾[TEACHING ASSISTANT](#) ▾[OUTPUTS](#) ▾[EVENTS](#) ▾[Glossary](#)[Home](#) / [Outputs](#) / [Glossary](#)

PSYCHOLOGY

Role Model	^
Unconscious bias	^
Implicit bias	^

GENDER

Gender Stereotype	^
Feminism	^
Gender awareness	^
Gender Sensitivity	^
Gender Gap	^
Gender Equality	^
Gender Equity	^

The Gender4Stem website will provide you with a glossary with definitions and explanations of often-used terms, linked to young girls and women in STEM. These definitions aim at enhancing the comprehension of these specific terms.

OUR PARTNERS' WEBSITES

We also advise you to have a look at the websites of the partners of this Gender4Stem project. They will provide you with interesting information regarding their area of expertise.

● Consulio

<https://www.consulio.co>



● Smart Venice

<https://smartvenice.org>



● VHTO

<https://www.vhto.nl>



● WIDE

<https://wide.lu>



● LIST

<https://www.list.lu/fr/>



● PRoF

<http://professionalcentre.ro>



CONCLUSION



Gender 4 STEM brought together 6 partners from Romania, Netherlands, Luxembourg, Italy and Croatia who put together their expertise in gender issues, e-learning and teaching, and technology Research & Development to contribute to bring new solutions to reduce gender gap in STEM, especially for the purpose of being use the context of secondary education. This publication presented a selection of resources and material for teachers, educator, staff in charge of career counselling and guidance as well as management staff in schools and policy makers interested to find out more about what can be done to encourage more girls to consider and choose the field of STEM.

The resources presented aim in particular to challenge and rethink the way of teaching STEM to boys and girls in secondary school, at adolescent age, when important career and studies choices are made. Many studies and reports show that Europe and the World need more scientists. At the time of publication, the world is hit by the Covid19 crisis. There is still a long way to go to encourage young people to pursue their interest in STEM and turn it into a career. We hope that reading this publication has given the reader actionable and practical resources engage the discussion with colleagues, stakeholders and students and therefore be able to contribute in their own way to be part of the change.

GENDER AWARE EDUCATION AND TEACHING IN STEM

Nowadays, innovation is mainly driven by Science, Technology, Engineering and Mathematics (STEM) disciplines. STEM skills are recognised as being key to rising to current challenges, which are leading to become knowledge-driven economies and societies.

The problem is that girls seem to lack a calling for these disciplines and they are also very under-represented on courses in the disciplines in question. Culture, education, training, recruitment practices are vectors of gender stereotypes partly to be accounted for the low level of participation of girls in STEM.

This is why Gender4STEM was launched! See how the project team aims to tackle low representation of girls in STEM.