



toolkit

Hypatia
PROJECT

MUSEUM

INTRO

The toolkit is a ready-to-use digital collection of modules aimed at teenagers to be used by teachers, informal learning organisations, researchers and industry.

The aim is to engage young people and especially girls in STEM and in the discovery of the variety of STEM related careers in a gender inclusive way. The toolkit includes a wide range of hands-on activities: workshops with a scientific content, informal discussions and meetings with STEM professionals.

Each module is composed of three guidelines:

- Explanatory guidelines specific for each activity
- Guidelines dedicated to the theme of gender inclusion
- Guidelines with suggestions for the facilitation

The guidelines give practical support and guidance for the users, recommendations on how to debate gender approaches and differences with young people, support and guidance for facilitators on how to overcome their own stereotypes and suggestions on how to manage the group dynamics by implementing different facilitation strategies.

The toolkit is produced in the context of the Hypatia project by five science centres and museums (NEMO Science Museum, Museo Nazionale della Scienza e della Tecnologia “Leonardo da Vinci”, Bloomfield Science Museum Jerusalem, Experimentarium, Universcience) in collaboration with gender experts, teachers, research industry institutions and teenagers.

The Vision of Hypatia is of a European society that communicates science to youth in a gender inclusive way in order to realise

the full potential of girls and boys around Europe to follow STEM related careers.

Below is the complete list of modules that compose the Toolkit, divided into the three contexts.

Schools

- Find Gender Stereotypes in STEM Representations
- Gender Inclusiveness in your Science Teaching
- Inquiry: Shape and Action
- Play Decide Game & Debate
- Science Ambassadors and Ambassadors
- STEM Women Cooperative Card Game
- Test Yourself
- What's your Opinion?

Science Centres & Museums

- Find gender stereotypes in STEM Representations
- Science Café or *Café Scientifique*
- STEM Women Cooperative Card Game
- Test Yourself
- Wearable Technology
- Your Role in Research: Inquiry into Chemical Reactions

Industry & Research Institutions

- Gender optimizing software programming
- Science Ambassadors and Ambassadors
- Skill Game
- Speed Dating
- Your Role in Research: Inquiry into Chemical Reactions

GUIDELINES ON GENDER BALANCE

WHY IS IT IMPORTANT FOR PEOPLE OF ALL GENDERS TO STUDY AND WORK IN STEM AREAS?

In the coming years, with Europe's knowledge economy developing and new technologies on the rise, skills in science, technology, engineering and mathematics (STEM) are becoming increasingly necessary in order to guarantee an adequate & professional workforce in a broad range of careers. It is therefore imperative to attract and recruit more youth to STEM study programs and ensure the diversity of STEM-trained professionals. The Vision of Hypatia is of a European society that communicates science to youth in a gender inclusive way in order to realize the full potential of girls and boys around Europe to follow STEM related careers.

Institutions and facilitators responsible for implementing science education activities, such as schools, museums and industries have a key role in this. They may influence the ways in which learners construct and negotiate their gender and their attitude towards STEM. This is why it is important to reflect on the gender and science biases we have, to acknowledge the stereotypes and make sure we do not perpetuate them in our interactions with the participants.

FACILITATING GENDER INCLUSION

In facilitating gender inclusive activities it is important to be aware of a few significant concepts.

GENDER AND SEX

Sex refers to biological characteristics and functions which distinguish between males and females: chromosomal sex, gonadal sex, morphological sex.

Gender refers to the social construction of men and women, of masculinity and femininity, which differs across time and space, and across cultures. It is a hierarchical and hierarchizing system of masculine and feminine norms.

GENDER STEREOTYPES AND SKILLS

A gender stereotype is our social perception regarding the attributes of males and females (character, abilities, tendencies, preferences, external appearance, types of behavior, roles, career paths etc.) and our tendency to relate such attributes to individuals of each sex, prior to meeting them (example of stereotype: male are more rational and female more emotional).

When we talk about gender stereotypes and science we refer to roles and abilities that are supposed to be "suitable" for males and for females in science (for example engineering and building are associated more with males than with females).

GENDER AND SCIENCE

STEM are fields of inquiry and knowledge. Like other forms of knowledge, they may include gendered dimensions. When the gender variable is not taken into account by researchers, this can influence the results: for example when medicines are not tested on both male and female. Furthermore, there is a persistent gender gap in the production system of scientific and technological knowledge and in many European countries women are over represented in biology and medical sciences while they are

under-represented in mathematics or informatics. Besides, women are less likely to reach a high level of responsibilities in sciences.

They are depicted as rational, intellectual and independent, and these characteristics are often associated with masculinity. This means that boys or girls who do not identify with such characteristics will think that STEM studies and occupations are “not for them” and avoid STEM completely. This is why it is important to present a complex and diverse image of science.

SUGGESTIONS FOR THE IMPLEMENTATION OF THE ACTIVITY

Defining, recognizing and implementing gender inclusive activities is complex and challenging and requires a constant auto reflexivity of the facilitator about his/her own gender stereotype and bias. Here are some practical indications and reflection questions to assist the facilitator in being inclusive.

INTERACTING WITH THE GROUP

- **Neutrality in assigning tasks and roles**

How will I assign tasks? What responsibilities will I assign and to whom?

Avoid assigning stereotypical gendered roles to participants that may contribute to the internalization of ‘female’ or ‘male’ identities, for example asking boys to build things and girls to take notes. Ensure that the different roles required by the activity are rotated between participants.

- **Attribution of success and failure, overcoming stereotypical responses**

Do male students who have failed link their failure to themselves or to external factors?

Do female students who have succeeded link their success to themselves or to external factors?

Set a high level of expectations for both sexes. Avoid over indulging with the girls (this leads to dependency rather than independence). Encourage both girls and boys to take risks.

- **Adopt a “Wait Time” to encourage girls to speak in an environment of risk-taking boys who might respond faster than they do**

How attentive was I to the students’ responses? How long did I let them speak for?

Wait 4–5 second before calling on a student to answer a question. Delaying the answer enables all the students to respond, thus giving everyone the opportunity to come up with it.

- **Interaction with the sexes to overcome the tendency to engage with male students more than with females:**

Did I direct questions to boys more than to girls?

Be aware whether the questions are directed more to boys or to girls.

- **Unaware expression of stereotypes**

Did I pay attention to the students’ behaviour in relation to their expression of gender stereotypes?

Teenagers often reproduce gender stereotypes unconsciously or in a subtle way. This might be taken as the chance to underline it and use it as a point of reflection.

DURING A DISCUSSION

- *Are boys more interested in building things and girls in decorating the things produced? Can you switch these roles in the activities?*

Challenge learners to depart from their preferred interests and widen their engagement in science (many children have gender stereotypic interests that might be challenged).

- *Do you think it could be useful to introduce and discuss the concept of gender or stereotype before or after the activity?*

Consider if a forgoing explanation of the main concepts about gender and about the terminology/concept connected could enrich the discussion.

- **While facilitating a discussion**

Acknowledge that different learners have different kinds of prior knowledge that may be relevant in different ways. Discussion can take its point of departure in what learners already know about the subject matter.

MEETING A STEM PROFESSIONAL

Role models are effective in stimulating girls' and boys' interest in STEM. Many activities have STEM professionals as protagonist or give examples of STEM professionals. It is important that these role models do not reinforce gender stereotypes.

- *How many men and how many women appear in the example of STEM professionals I give in the activity? Are they stereotypical?*

Keep a balance between the number of females and males as speakers or examples. Where possible ask them to talk not just about the scientific content but also about their personal life.

Ensure that the involved science educators and scientists reflect a broad variety of personalities. Girls and boys are most inspired by role models they feel psychologically similar to themselves (as regards to origin, culture, age, etc.). Otherwise, the standards set by the other person can be seen as contrasting, and girls and boys may react against them.

- *In the activities, do I present the variety of STEM – from computer games to engineering?*

While choosing STEM professionals and examples involved in the activity, ensure that the diversity of science is represented to the largest extent possible.

FACILITATING AN EXPERIMENTAL SITUATION

While dealing with a specific scientific content participants might not see clearly how this is related with gender balance in STEM. Hypatia activities aim to propose unexpected ways to approach science and scientific content (like chemistry, robotics or making), breaking the stereotypical perception of STEM. This serves to introduce and disseminate a different view of the world of science, unveiling different aspects with which more people – girls and boys – can identify. You can emphasize this aspect while facilitating an activity focused on scientific content rather than on gender.

- For example, an activity framing technology such as the one on wearable technologies could attract more girls than one on transport or missiles.
- Many girls feel more comfortable in a situation based on cooperation, and others even avoid competitive activities. The facilitator could present a challenge with a “story” behind and not just as a competition, or pay attention in balancing competition and cooperation in the same activity.
- Many studies show that girls learn better in an environment that is esthetically pleasing. This is why it is important to create a pleasant and esthetic environment for the activities.

USEFUL LINKS ABOUT GENDER INCLUSION IN THE CLASSROOM

HYPATIA’S THEORETICAL FRAMEWORK

The present document proposes a framework to address gender inclusion in STEM activities. It gives rise to a set of criteria for the analysis of the gender inclusiveness of existing STEM education activities, or for the design of new, gender-inclusive activities.

[Theoretical Framework](#)

GENDER EQUALITY IN THE CLASSROOM

We are frequently unaware of the manner in which we relate to boys and girls. School classrooms are no exceptions. Here is a list of points of attention and suggestions aimed at improving the degree of equality in the class in order to encourage girls and boys to pursue the fields of STEM.

[Gender Equality in the Classroom](#)

GUIDELINES ON FACILITATION

A BIT OF ADVICE FOR GOOD FACILITATION

A key element for good facilitation is the active involvement of the participants every time a concept or content is presented.

Involvement means for example:

- Considering participants' personal experience as a starting point of the engagement.
- Building on their own point of view or prior knowledge.
- Embedding continuously the contributions of the participants in the process.

Facilitation is not easy; it takes practice, time and reflection! In order to transfer these concepts into practical situations – and thus to foster engagement, interaction and discussion – you can find a brief list of suggestions below. They can be helpful in developing good facilitation.

INTERACTING WITH THE GROUP

- Prepare the environment where the activity will take place in advance, organize the space according to the needs of the activity, even changing its usual structure if needed (i.e. you can move tables and chairs around).
- Make sure that all participants can see and hear well.
- Keep eye contact with the participants.
- Address participants as peers rather than as passive spectators or ignorant individuals.
- Listen to people and use their own terms.
- Use questions as much as possible – they can be a useful tool to encourage interaction among the group.
- Stimulate reflections among participants.

- If possible, ask and build on information or elements that can be discovered through direct observation.
- Engage people by linking to their personal experience.
- Encourage participants to express their opinion and elaborate their own considerations.
- During an activity, you might want to organise different group settings – work in smaller groups or in pairs, create plenary moments – to help engagement and better interaction with the experience.
- Before interacting with the participants in plenary, you might want to ask participants to discuss in small groups as a “warm up”. This helps involving the shiest people or helps everybody to feel more comfortable about the topic before sharing any consideration in plenary.
- When the discussion is set in small groups, move around the groups checking on work and discussion, and intervene – only in case of difficulties!
- In plenary, try to address everyone as much as possible, encouraging everybody to participate and engage.

FACILITATING AN EXPERIMENTAL SITUATION

- Try to make the activity as participatory as possible: every participant should have the possibility to engage directly with the experiment; avoid demonstrations.
- Do not reveal the results of the experience before the participants' own discoveries and considerations.
- Encourage participants to make initial hypotheses/descriptions/comments about what they think would happen.
- Keep the experiment at the centre of attention and of the discussion.

- Engage learners through an alternation of manual activity, questions and discussion.

DURING A DISCUSSION

- Engage learners through a balance of open-ended questions, closed questions, discussion and exchange of opinions, etc.
- You might want to use provocative dilemmas as tools for debate. Disagreements can be valuable for analysing notions and negotiating views, use them constructively.
- Stimulate and build not only on participants' already-acquired knowledge but also on emotions and imagination.
- Challenge the participants at a suitable level.
- Avoid:
 - A didactic approach and the assessment of participants' knowledge.
 - Monologue.
 - Specialized terms with no reference to real objects.
 - Seeking and dealing only with the correct answers or, even worse, with the correct questions.
 - Not listening.

HOSTING A STEM PROFESSIONAL

- You might suggest to the speaker to alternate between questions and speech allowing participants to take up a more active role and prevent long talks.
- Before introducing a STEM professional, you can ask participants to share their perception about the particular profession, and then discuss it with the speaker.

- Young participants, when they have the possibility to ask free questions, often seem to be interested in the speaker's daily personal lives, in their career path and about what they were like when they were students. You can suggest that speakers use these topics as "hooks" during speeches and conversations.

It helps if speakers bring tools or objects from their daily work with them as examples from their daily practice.

QUESTIONS: A FUNDAMENTAL TOOL FOR LEARNING

Building a relationship with an object is like 'getting to know a new person'. Indeed, this kind of comparison can help understand a possible way of developing questions to be used in learning experiences. In the process of getting to know a person or starting a conversation we move from the basic and concrete to the abstract and more complex. Using questions in a learning situation involves similar steps: starting from basic information (usually elements that could be discovered through observation) working at levels where there is compatibility (i.e. levels where the pupils can become involved and engage through their knowledge, experiences and views), in order to proceed to the discovery of more complex information and concepts. Such an approach invites learners to search within their own repertoire of knowledge and experience for the necessary elements that would help them discover new insights, while at the same time it can operate as the foundation for the development of questions by the learners themselves.

In fact, we are not arguing here for a linear process of 'facilitator-asks – learners-answer'; rather, we argue for a two-way-contribution process, in which both facilitator and

learners are in the position to ask and answer questions. In this sense, questions are the stimulus for initiating dialogue, the tool and *not* the objective. They help new knowledge to be elicited and information to be added within a free flow of ideas, leading to the broadening of understanding.

What are the types of questions that would operate as the method for eliciting information and interpretation, for initiating constructive dialogue, for developing skills and self-confidence in learners – and facilitators themselves?

First of all the basic categories:

- Closed questions – the ones that have only one correct answer.
- Open questions – those that accept more than one correct answer.

Closed questions are usually used when we seek specific information about the phenomenon/topic/exhibit/object etc. and can be further divided to:

- Questions for examination: Answering those questions requires careful examination. The answers offer the first information on the basis of which we construct more detailed knowledge.
- Questions for explanation: The answers offer an explanation – how something works, how it was created, etc. and are closely related to the information derived from the examination questions.
- Questions for comparison: These stimulate comparisons with other situations of the same type, materials, dimensions, etc. and encourage the identification of similarities, differences and connections with the learners' personal knowledge and experience.

On the other hand, open questions encourage the expression of personal views, the employment of pre-existing knowledge of the learners, and the search for personal meanings. Discussion and open-ended questions offer learners the opportunity to pool ideas and share insights in the group followed by opportunities to develop understandings further through deploying and defending insights and opinions.

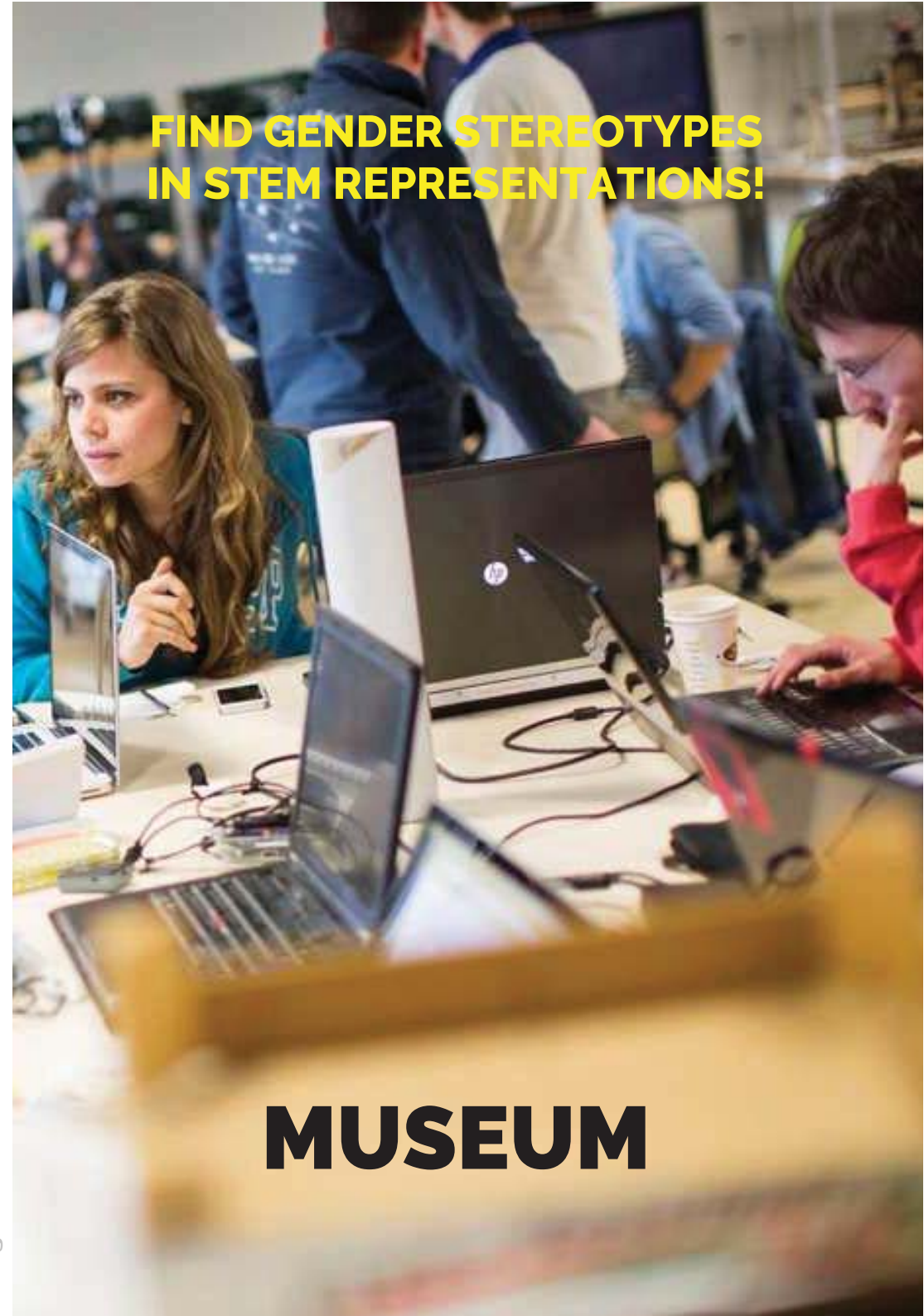
Open questions can be divided into the following categories:

- Questions for problem-solving: Those demand the use of critical thinking, imaginative thinking, hypothesis and analysis skills and ability for using knowledge for problem solving.
- Questions for prediction: The answers to those questions offer predictions in instances of changes of parameters.
- Judgement questions: Answers to those can be very personal and unique. They demand choices, evaluation of a situation, justification, etc.

You should be seeking a balance between closed and open questions. Asking only closed questions might create a feeling of ignorance among those learners who find it difficult to answer them, since they require relatively minor use of skills and more of specialised knowledge. Closed questions should be used for exploring the object and the new knowledge around it, and, in addition, offer the basis on which to ask the open questions. For any learner, answering open questions implies using their personal context to find the new information. It also enables them to use their own personal experiences, emotion, imagination and skills for meaning-making and personal interpretations.

In the philosophy of an interactive, constructivist approach to learning, the asking-answering of questions means not only the acceptance of more than one correct answer (through open questions), but also 'allowing learners to get things wrong', that is, not allowing a learning situation to be limited by seeking only 'correct' answers, or by the expectation of pre-determined outcomes. It is important that the facilitator does not jump in too quickly to correct learners, but rather uses the conflicts that arise between their different perspectives helping them to see that there are standards and that their own interpretations are not necessarily the same or as good as those held by other learners. Learning results from reference to, and drawing from, learners' own understanding of situations, and opportunities for exploration through trial and error.

**FIND GENDER STEREOTYPES
IN STEM REPRESENTATIONS!**



MUSEUM

FIND GENDER STEREOTYPES IN STEM REPRESENTATIONS!

AT A GLANCE

Age Group	School aged students (with a focus on teenagers)
Format	Moderated discussion
Duration	1hr 15 minutes

OVERVIEW

The workshop focuses on gender-stereotyped representations of science and technologies in advertisements for technological objects (such as computers, smartphones, video games, cars, etc.) and recruitment campaigns for schools, training, or jobs in STEM fields. Through the discovery, comprehension and analysis of stereotypes in these visuals, students will be led to question:

- How these stereotypes influence the way they view the skills/abilities associated with women and men in science and technology.
- How these stereotypes influence their choice of studies and careers.

OBJECTIVES

- Understand what sex and gender stereotypes are and identify them.
- Heighten students' awareness of stereotypes in their daily lives.
- Increase awareness about the negative impact they can have on their own representations of sciences, the world

of science and technology, and their study/career choices.

- Learn about careers in STEM and develop an interest in them, regardless of their sex.

SUGGESTED SCENARIO

The activity is designed for a class of students. It could take place during a research centre/museum 'open day' or for the International Women's Day. It could also be implemented as a workshop or as an open lesson for schools (for example within IT lessons if using computers for Google Search etc).

TARGET AUDIENCE

Age	School aged students (with a focus on teenagers)
N. participants	20 -30
N. facilitators	1
Type of audience	Students

FORMAT

Moderated discussion.

TOPICS COVERED BY THE ACTIVITY






This activity deals with science and technology in general with a societal approach. In France, this workshop has links with the civic education curricula that promotes gender equality; the mechanisms of sex-differentiated socialization are also studied in high school economic science classes.

DURATION OF THE ACTIVITY

90 minutes.

RESOURCES

MATERIALS

Computer		1
Video projector		1
Flipchart		1
Visual Images	Google search, newspaper	6 (3 different ads + 3 different campaigns)
Pen or pencil & paper		1 per student
Post-its		100
Analysis grids	See "Development of the activity"	6 (1 per group per visual)

NOTE:

To prepare for the activity, facilitators will need to choose the ads that will be shown during the workshop and prepare the analysis grids that will be distributed to students.

USEFUL LINKS, VIDEOS, ARTICLES

- The TWIST project: <http://www.scientix.eu/projects/project-detail?articleId=57549>
- Expect Everything campaign: www.expecteverything.eu
- Hypatia Project [D2.1 \(Criteria for Gender Inclusion\)](#) and [D2.2 \(Good Practices on Gender Inclusion in STEM Communication\)](#)
- The most appropriate images, visuals in each country: recent ads for smartphones, computers, video games, recruitment campaigns for researchers or STEM careers in engineering, transportation, energy, nuclear, aeronautics, or information flyers on science and technology programmes at universities and higher education establishments.

SETTING

Closed and modular space so tables can be moved to work in small groups.

DESCRIPTION AND TIME SCALE

GROUP MANAGEMENT

Students will work in plenary sessions and small groups, preferably mixed boys and girls.

INTRODUCTION, 5 MINUTES

Quick introduction explaining to students that they are going to comment on advertisements for daily technological objects and recruitment campaign visuals, followed by an analysis and discussion. The facilitator or teacher will emphasize that they are really interested in what the students think.

DEVELOPMENT OF THE ACTIVITY

Step one, 15 minutes

- The activity begins with a question: *What are the skills, ideas, adjectives, qualifiers that you spontaneously associate with men, boys, girls and women?*
- Give 2 post-its to each student: they will write what they associate with women/girls on one and what they associate with men/boys on the other.

Note: post-its are anonymous, a very short period of time is given to write down the associations.

- The post-its are then stuck on the flipchart, arranged into 2 columns: one column for words associated with women/girls and one for words associated with men/boys. They will be commented at the end of the workshop.
- The person leading the workshop (the facilitator) then explains the general notion of stereotypes, clichés, preconceived ideas.

Note: definition of sex and gender stereotypes:

- Sex and gender stereotypes are over-generalizations of what girls and boys/men and women are and are not, by nature: "women have no sense of direction", "men are tech-savvy", "women are intuitive", "men are not emotional", etc.

- How do they work? Sex and gender stereotypes legitimize the roles of each sex by "naturalizing" them: they make the different and hierarchical roles of sexes assigned to men and women seem biological and natural.

Step two, 30 minutes

- The facilitator shows the first ad and the group comments on it together to give students an idea of how to analyse an image.
- The students are asked to form groups, preferably mixed girls and boys.
- The facilitator gives each group the choice of discussing recent adverts, recruitment campaigns or other gender stereotyped examples. For examples please see suggestions for content below. The adverts can be printed or visually displayed on the screen or researched by the group. In the UK we are keen to allow open discussion of current media portrayal and include discussion of what people are getting right as well as what is still wrong, adverse gender stereotypes affecting girls and boys and using current adverts and products available rather than hand-picking examples. For example
 - Google Search for "computers for girls"
 - [Large Image Google Image Search 'scientist', 'engineer', 'computer game', 'teacher'](#)
 - [Let Toys Be Toys Let Books Be Books Campaign](#)
 - [Analysis of current UK TV adverts](#)
 - [Gender stereotypes within TVs popular Big Bang Theory](#)

Note: The following points can be analysed:

- the link between the object in the ad and the person or people shown in the image
- the target audience of the ad
- the construction of the image
- the size of the different elements in the image and their connection
- the colours used (boy/girl gendered colours)
- description of the people: activity, posture, body part featured, clothing (or nudity), accessories
- gaze: direction of eyes, intent
- mouth: position of lips, smile, lipstick, etc.
- hair: length, colour, done up or loose
- relationships between men and women: position, expression, size, attitude, etc.
- text

The aim of this step is to highlight associations that advertisers make between technical skill and, in most cases, men; this stereotype often portrays women as incompetent or seductive, and also gives a very narrow and formatted view of masculinity.

- Attention is given to the people represented and the field or place where they are represented: for example, in a recruitment campaign for researchers of all disciplines, a woman is shown in a laboratory in the foreground, another photo shows a medium shot of a man contemplating the stars. This distinction between interior/exterior, infinitely small/ininitely large, is produced in recurring stereotypes.

- Students are asked to identify and discuss the sex and gender stereotypes in the visuals, to fill in the analysis grid, and discuss their observations.
- The teenagers will have a sharper eye after the first step of the activity, but they will still have to consider the presence of stereotypes by themselves in these pictures and the impact they can have when they think about a career in STEM jobs. The previous grid will again help to raise their awareness.
- This step will conclude with a look back at the post-its. Students will compare what was written on the post-its, i.e. women/girl and men/boy word associations:
 - with the stereotypes identified in the ads for technological objects
 - with the stereotypes tied to careers in science and technology

In most cases, there will be many similarities.

- The facilitator asks students for their opinion and launches a discussion on the impact stereotypes have on study/career choices and the representation of careers in STEM.
- The facilitator emphasizes that jobs should be mixed-gender, the need to choose one's studies and career based on skills and likes/dislikes without the influence of preconceived ideas.
-

Step three, 30 minutes

- Each group chooses a presenter, boy or girl. During the plenary session, each presenter explains the group's findings to the rest of the students.

- A group discussion can follow to give everyone an opportunity to share his or her opinion.
- The facilitator can further comment if necessary and briefly explain what is meant by "gender" and sex and gender stereotypes.
- The resource from the WISE Campaign [People Like Me Resource Pack](#) can be used to show the wide variety of STEM careers and encourage stronger identity with STEM.

CONCLUSION

The activity ends with:

- students' general feedback on the workshop
- a quick presentation of images of "role model" women in various fields such as engineering, astronomy, video games, etc.

The idea is to show students that skill and success have nothing to do with a person's sex.

PARTNER DETAILS

This module was originally developed by Universcience, Paris, France.
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SCIENCE CAFÉ OR CAFÉ SCIENTIFIQUE



SCIENCE CAFÉ OR CAFÉ SCIENTIFIQUE

AT A GLANCE

Age Group	School aged students (with a focus on teenagers)
Format	Meet a STEM professional
Duration	2 hours

OVERVIEW

The Science Café focuses on broadening the scope when it comes to choosing a future career. Many girls find it difficult to see themselves within the field of science and technology and specifically within the field of technology. Some of this is due to boundaries often associated with gender.

This activity is a facilitated discussion following the principles of *Café Scientifique*. Facilitators educated in these principles will create a dialogue meeting between a couple of female scientists from various fields and a group of teenagers. The topics to be discussed will be chosen by the researchers, and facilitators will create the discourse for the meeting. Researchers should be asked to also focus on their career and touch on the challenges they have met and how they managed to overcome them.

Following the opportunity to meet with real life scientists, participants are given the chance to reflect on what role gender plays when choosing a future education and career, and in what way gender has affected the professional lives of the female scientists.

OBJECTIVES

The objective is to enhance awareness about the possibilities in the world of science and break down possible (un)conscious biases people might have about scientists with a specific focus on female scientists. Many teenagers lack a variety of real life role-models they can relate to, and the Science Café gives them the opportunity to meet up with researchers that can tell about their personal motivations and choices – and the challenges and opportunities they have met along the way. The participants may even be inspired to choose a career within STEM.

SUGGESTED SCENARIO

The scenario is well-placed in an informal science learning setting such as a science center or museum. It can also be placed in other settings, where a group can be gathered in a relaxed, egalitarian and informal way. It is important that the setting creates an atmosphere, where you are not expected to take notes, rather the participants should be inspired to enjoy themselves and engage in discussions. It is a place where anyone can come to explore the latest ideas in science and technology and can also take place in cafes, bars, restaurants and even theatres, but always outside a traditional academic context.

TARGET AUDIENCE

Age	School aged students (with a focus on teenagers)
N. participants	20 - 50
N. facilitators	2
Type of audience	Teenagers and their teachers

FORMAT

Presentations by role models in science and moderated plenary discussions.

TOPICS COVERED BY THE ACTIVITY

This activity aims towards giving career guidance targeted to teenagers in regards to the education and career paths they might choose or aspire to choose and specifically focusing on STEM careers.

DURATION OF THE ACTIVITY

Suggested duration: 1 hour + Conclusion

RESOURCES

This moderated discussion uses a mix of presentations and Q&A-sessions.

The following table with recommended materials will cover any needs for running the workshop.

MATERIALS

Video projector and screen		1
Coffee/tea and cake or biscuits		Enough for all participants
Poster post-it or flipchart		1

USEFUL LINKS, VIDEOS, ARTICLES

- Cafescientifique.org
- sciencecafes.org
- [The Twist Project](#)
- [Hypatia project](#)
- [Institute of Physics 10 Tips for inclusive Science Teaching](#)
- [Tips to Improve Gender Awareness \(Twist\)](#)
- [Gender Inclusion: Suggestions for STEM engagement professionals](#) from the Hypatia Theoretical Framework

SETTING

The venue needs to strike a balance between being large enough to accommodate the audience and small enough to allow them to hear each other and interact successfully. We recommend that the size is 20-40 persons. Above this number it can be hard to have a lively discussion, where everyone feels addressed.

Set time aside to let the teenagers engage in activities or exhibits after or during the Science Café if it is held in an institution that has such activities. These can range from engaging in a science exhibition on water to engaging in an activity that focuses on health for example. This will also give an opportunity to further inspire and engage.

Sometimes teenagers see science as difficult, boring and 'a closed world of its own'. By putting science back into culture and everyday life – and doing it in a setting, where everyone is feeling comfortable – it hopefully becomes relevant and intriguing.

DESCRIPTION AND TIME SCALE

GROUP MANAGEMENT

Science Café will usually be held in plenum, yet it is optional for the researchers to suggest small group discussions during the café in order to engage all of the participants.

INTRODUCTION

The Café Scientific starts with an introduction to the researchers and the aim of the day – to broaden and inspire towards the scope of possible education and career paths for the participants. Facilitators will encourage participants to ask questions, participate in discussions and otherwise contribute from the very beginning.

DEVELOPMENT OF THE ACTIVITY

It is important here to mention that the following is merely meant as examples and can be seen as inspiration to the organisers and researchers. The different parts included in the examples will also vary from country to country and from institution to institution.

The number of speakers is one of the first things to consider. Is a single speaker enough if combined with a well-facilitated discussion? It can be. Yet, often two scientists will cover a broader spectrum of science and give different perspectives on STEM and also on gender-related issues. Three or more is also an option, but it requires that the facilitators can balance the different parts of the café in order to make room enough for each scientist, yet keeping an eye on the overall timeframe. This risk if you have a 'panel' of speakers is that the audience becomes viewers of, rather than participants, in a debate.

It is crucial that the visiting scientists are good at addressing and relating to the participants.

It can also be a good option to mix different kinds of speakers, so that different perspectives are given and discussed. Scientists are one kind of group (that can easily be divided into several subgroups), yet also people from other parts of society can be inspiring, when it comes to discussing STEM and gender, e.g. philosophers and sociologists – maybe even politicians.

In order to get the right persons as speakers, take contact to different groups and organisations. It can be outreach departments of your nearest university, scientists that are used to work with education and teenagers, the local council, NGO's. It all depends on what works in your local circumstances.

At the beginning of the café suggest introducing gender and why it is important to reflect on and even challenge gender stereotypes when considering a future career path.

Suggested program and time schedule:

- **5 minutes welcome and introduction** to Science Café, the topic is briefly introduced, welcome to participants and researchers and welcome to the 'set-up' – which is briefly explained.
- **2 x 10 minutes talks.** Each scientist (or other speaker) presents themselves, their fields, personal choices and considerations and challenges they have met along the way. Q&A sessions after each presentation.
- **35 minutes discussion.** It might be a good idea to prepare the overall discussion question with participating teenagers before the Science Café. This would also add to a sense of ownership. It might even be a possibility that

one of the participating teenagers presents the discussion question in the beginning and why they have chosen it. The following question is simply an example of what a question might look like: “Is it a problem that fewer girls than boys choose to follow a career in science and technology?”. The discussion is facilitated by the organisers.

- **Conclusion, 10 minutes.** What do we take home from the café?

CONCLUSION

To conclude the Science Café we end with an evaluation and reflective feedback. Participants are asked to discuss in small groups (or two and two) if this has made them reconsider the options they have in regards to choosing a future career path and study. Equally important is whether their view upon gender and the career stereotypes often associated with these has either changed or been challenged.

After the groups or pair discussions there will be a short plenum discussion. The organisers thank the researchers and teenagers (and teachers) for showing up and taking part in the café.

GENDER INCLUSION CRITERIA

The “gender inclusion criteria” developed in the Hypatia project are relevant for the adaption of software programming classes and should be reflected on and discussed with the people who are offering such a class or activity. Even more they might lay the ground for the success criteria in which to measure the results of the adapted activity. The following are some examples of how this workshop addresses gender inclusivity on the different criteria levels.

INDIVIDUAL LEVEL

- Includes presentations or talks by scientists, who are asked beforehand to reflect on their own experiences as women (or men) in science. They bring their experiences to the participants, who are about to choose their own careers.
- Introduces participants to the concept of gender and the role it plays when choosing what to study.

INTERACTIONAL LEVEL

- Will alternate between different types of discussion formats such as group discussions, plenum debates and for example short discussions in small groups.

INSTITUTIONAL LEVEL

- Can take place in a physical learning environment where participants can come together in plenum. It might be supportive if the setting is informal and could be followed by a chance to try out hands-on activities or other exhibits related to science – in other words perhaps in a science center or museum.
- Might bring up how an institution might influence the teenagers’ feeling of being included and discuss and reflect on what gender representations are found and used in their school or workplace.

SOCIETAL/CULTURAL LEVEL

- Will touch on the way gender is implicitly or explicitly conceptualized in society in general and how this concept is created and maintained through media, politicians and other powerful groups. Depending on the time participants can reflect and discuss more on this.

LEARNING OUTCOMES:

- At the end of the Science Café the participants should be able to:
 - Reflect on different career options in STEM and how gender biases may influence their own understandings of possible study and career paths.
- At the end of the workshop participants should have acquired some of the following:
 - Knowledge of certain career possibilities within STEM.
 - A clearer understanding of what being a scientist might encompass.
 - Understanding of everyday life and/or careers of scientists.
 - Some knowledge on gender issues in science
 - Knowledge and ideas that can inspire them when choosing a future career path.

PARTNER DETAILS

This module was developed by the Danish Science Center Experimentarium, Hellerup, Denmark.

EXPERIMENTARIUM

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Cover image: the Danish Science Center Experimentarium,
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YOURSELF! THE INFLUENCE OF OUR IMPLICIT ASSOCIATIONS

AT A GLANCE

Age Group	Teenagers from 15 years old, adults (including STEM educators from school, science centres and industry settings)
Format	Online Test and Moderated discussion
Duration	About 50 minutes

OVERVIEW

This activity explores the participants' sub-conscious associations regarding the connection between gender and involvement in STEM subjects (sciences, technology, engineering and mathematics) and the liberal arts.

The activity starts with individuals doing the [Online Harvard Project Implicit Test](#) on Gender-Career, which explores whether the players tend to relate certain subjects to a particular gender. This test is well known in the UK and taking the online version allows the group to gather and discuss group data and measurements scientifically recorded from participant's reaction time. Through the test, the participants are exposed, in a non-obligatory way, to the gender bias embedded in their sub-conscious, which is likely to influence their behaviour without conscious intent. Thereafter, a group discussion is held, as well as a discussion in the plenum, on the influence of latent associations regarding gender, and their impact on the females' choice to study and to later work in STEM areas. In the UK, STEM educators are also provided with specific guidelines, briefings and/or CPD events to train them in recognising and monitoring their own unconscious bias.

**The activity is based on the IAT (Implicit Association Test) that measures the implicit opinions and beliefs that people do not want to, or cannot, reveal (in addition to gender, also race, weight, nationality, origin, skin colour and age). The test was developed by Tony Greenwald of the University of Ohio, a little over a decade ago. The test was developed and studied in various states through [this site](#) and on the [TWIST project](#).*

OBJECTIVES

- Exposing to the participants the gender biases implicit in their sub-conscious.
- To be aware of their implicit gender biases in order to reduce their impact on their behaviour and on their decision-making.
- To enable participants to make a more rational decision regarding the choice of STEM area in their studies and future careers.

SUGGESTED SCENARIO

At the museum in the following frameworks:

- A meeting for students on a scientific topic of choice, that includes a module about gender and science;
- An event for students, to encourage the choice of STEM subjects.
- Training for science communicators, public engagement professionals, education team or external providers.

TARGET AUDIENCE

Age	Teenagers from 15 years old, adults
N. participants	20
N. facilitators	1 facilitator for 20 participants (no need of external experts)
Type of audience	School groups, groups of STEM educators

FORMAT

Online Test, Moderated discussion.

TOPICS COVERED BY THE ACTIVITY

This activity has an unspecified STEM content but it deals with the issue of encouraging teenagers to choose STEM studies.

DURATION OF THE ACTIVITY

About 50 minutes.

RESOURCES

MATERIALS

Link to the internet		
The following film on the computer or linked to	royalsociety.org	1 per group
Projector		1 per group
Computer		1 per person

Blackboard or white wall for projection		1 per group
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USEFUL LINKS, VIDEOS, ARTICLES

Before holding the activity, we recommend reading background material on the subject that includes statistical data and sources deal with the following topics: Why is it important to encourage equal opportunities? Possible reasons for the given gender inequality and proposals for improving the existing situation.

You can find data in English in the report from UNESCO: [Women in Science](#) and in the document [“Criteria for Gender Inclusion at the individual, interactional, institutional, and societal/cultural levels”](#).

SETTING

- The sessions should take place in an IT suite which enables students or adults to work individually on their Unconscious Bias Test.
- Arrange the room to also enable holding a discussion and watching a short film.

Please note!

- It is important to place the signs in advance in the correct order, so that one can immediately start playing, after receiving the instructions.
- It is important that before the activity, the person directing the game will him/herself play, enjoy the experience, and ask him/herself the questions arising during the discussion.

DESCRIPTION AND TIME SCALE

GROUP MANAGEMENT

The activity includes playing in pairs and discussion in plenum.

INTRODUCTION

Presenting the game, 5 – 10 minutes

The instructor introduces him/herself (name, the scientific/technological area of academic study, his/her stage in studies, etc.). Thereafter, the subject of the workshop is presented in general – "Workshop on Gender and Career in the Sciences and Technology Areas", and the instructions for the game are expounded.

The participants in the game are to classify the cards as fast as possible, according to the two categories appearing on the cards: A category of "female" or "male", and a second category of "Liberal Arts" or "Science and Technology".



Each of the words on the cards is suitable to one of category-pairs: male/female or Liberal Arts/Sciences and Technology. For example, in the category male/female, the word "daughter" pertains to "Female", while the word "son" pertains to "Male". In the category Liberal Arts /Science and Technology, the word "art" pertains to "Liberal Arts" and the word "physics" pertains to "Science and Technology".

Please note!

Some students don't know what liberal arts subjects are and what science and technology subjects are. It is highly recommended to

give them some examples and make sure they understand and will be able to sort correctly the cards according the two categories.

DEVELOPMENT OF THE ACTIVITY

Take the Test, 10 minutes

Discussion in the plenum, 10–15 minutes

Ask the participants:

- *Was the level of difficulty identical in both rounds of the game?*
- *In which pair of categories was the classification easier?*

Listen to the participants' comments.

The test, in fact, examines whether the players tend to relate certain subjects to a particular gender. Through the test, most of the participants are exposed in a non-obligatory manner to the gender bias implicit in their sub-conscious, which is likely to influence their behaviour without any conscious intent.

Studies based on this test show that most people usually take longer to place words associated with the exact sciences when they are connected to the category "Female" rather than to the category "Male", although there is no fundamental connection between the two categories. When there is an associative connection between the categories, people reply very quickly and attribute the word to the correct category, but it will them longer to answer when there is no associative connection between the two categories. But there is also room for optimism: researchers have found that although the stereotypical connection between science and masculinity is common globally (including in countries in which the indices of gender equality

are higher, such as Denmark and Norway), it is lower in countries where there were actually more female scientists! In other words, the more women there are in science, the less will be the gender bias and *vice versa*, the less the gender bias, the greater will be the number of women in science.

Please note!

- The results are likely to be affected by diverse external factors, such as distractions during the game. The game is intended to raise awareness of the subject.
- The claim is that those same biases in our sub-conscious can also affect our behaviour, our attitude towards males and females, and, of course, our decision making.
- For example, [a study conducted in Israel](#) (by Victor Lavy, Professor of Economics from Warwick University, England and the Hebrew University, and Dr. Edith Zand, an economist from the Bank of Israel), showed that in external examinations for 6th grade pupils, in which the examiners did not know the examinees' gender, the girls attained better results than the boys. In comparison, in those same examinations that were checked internally by teachers who knew the pupils, the boys obtained significantly better results. This result proves unequivocally that the school teachers discriminated against the girls in mathematical scores, based on a gender. This discrimination affects not only their future success in junior high school and in university, in these subjects, but is one of the factors leading to the absence of females from these professions in the labour market, and even to their lower incomes compared to males.

Questions for discussion:

The claim is that since parents and teachers see more women than men in the liberal arts subjects and more men than women in the

science and technology subjects, it may cause them to relate differently to boys and girls in the stage of choosing their course of study at school, and therefore, may influence their decisions making.

- Have you experienced a different attitude from the teachers towards girls and boys in your class?
- How can this affect their success?
- Are there differences at home in the way your parents encourage brothers or sisters to study science and technology?

Listen to the participants' comments.

Showing a short film, 5 minutes

Show a short animated film on the influence of our implicit biases on our decisions, opinions and choices, and on the importance of recognizing them and raising them to awareness. The film is accompanied by subtitles and concludes with the claim that the existence of implicit biases cannot be prevented, but awareness of their existence can reduce their impact. *We can't cure unconscious bias, but with self-awareness we can address it.*"

The link for this film is: <https://royalsociety.org/topics-policy/publications/2015/unconscious-bias/>

We recommend inserting subtitles in the suitable language to the film (approval is given by the Royal Society Organisation to insert translated subtitles in the film).

CONCLUSION

Summary, 5 – 10 minutes

We spoke about the implicit biases we all have that can influence the choice by girls and women of professions in science and technology.

- *Is it/why is it important for both groups to study and work in STEM areas?*

Hear the pupils' comments and summarise:

Culture is one of the main factors influencing the lesser participation of women in the world of science and technology. One piece of evidence for this is the existence of cultures in which both genders are represented and succeed equally in these professions. In the western world the participation of women in computer sciences is particularly low, while in eastern cultures, in Eastern Europe, in South America and in Africa, women are represented equally in this profession (and sometimes their percentage of participation is even higher than that of their male counterparts).

- *And why is it important for women to work in STEM areas? (Or you can also ask about the importance of participation of other minorities such as those based on the socio-economic status)*

Hear the students' comments and raise the following claims:

It is important for women to work in STEM areas for several reasons: The value aspect of social equality in an advanced society; for the benefit of society at large, it is important to create a culture that encourages diversity. Diversity enables the expression of diverse opinions and approaches necessary to

solving complex problems, and facilitates the full realization of the potential embedded in a particular society. If the potential of 50% of the population is not fully realized the entire society loses out.

GENDER INCLUSION CRITERIA

INDIVIDUAL LEVEL

- The activity enables all the participants to have an emotional experience in a simple card game on which the activity is based.
- The activity includes diverse formats of activity that enable different learners to be engaged: playing a card game, watching a short film and participating in a group discussion.

INTERACTIONAL LEVEL

- The activity includes playing and a group discussion, during which the participants discover that they all have the same experience of implicit bias regarding gender, and discover that none of them is free of stereotypical thought.

INSTITUTIONAL LEVEL

- During the discussion the participants broach situations that occur in their immediate environment, in school and at home, where implicit biases regarding gender are manifested. Bringing those implicit biases to the awareness in the context of gender and of STEM can influence the attitude of pupils/teachers to males and females regarding their choice of scientific and technological subjects.

SOCIETAL/CULTURAL LEVEL

- The activity exposes the participants to the impact of culture and society on the females' choice of STEM subjects in school and in their future careers.
- The activity exposes the participants to the opinion of policy makers (Ministry of Education, Ministry of Science and Industry) regarding the importance of adequate representation of girls and women in STEM subjects in school, in academia and in industry.

LEARNING OUTCOMES

At the end of the lesson:

- The participants should be aware:
 - That their implicit biases can influence their decisions, opinions and choices and that there is a big importance to recognize them and be aware of them.
 - That females can develop a career in STEM to the same extent as can males. The main reason that their representation is not compatible in some of these professions is the social attitude (of males and females) regarding the status of females in society.
- The pupils will be able to make a more rational decision when choosing an area of study in high school and later in the academia.

PARTNER DETAILS



מוזיאון המדע ע"ש בלומפילד ירושלים (נ.ר.)
متحف العلوم على اسم بلومفيلد القدس
Bloomfield Science Museum Jerusalem

This module was first developed by Bloomfield Science Museum Jerusalem, Israel. Contact: Eti Oron, etio@mada.org.il

Cover image: Courtesy Bloomfield Science Museum Jerusalem, Israel.

Hypatia PROJECT

Hypatia is an EU Horizon 2020 funded project that addresses the challenge of gathering different societal actors around bringing more teenagers, especially girls, into STEM careers both in school and as a choice of learning and career in the future. It aims at changing the ways sciences are communicated to young people in and out of school to make them more gender inclusive.

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