

**FIND GENDER STEREOTYPES
IN STEM REPRESENTATIONS!**

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

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.
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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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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.

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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