Erasmus+

Strategic Partnerships for

2020-2022

GE-STEAM TRAINING PROGRAMME

Co-funded by the Erasmus+ Programme of the European Union

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Project Identification

Programme	:	Erasmus+
Action	:	Strategic Partnerships for School
Project Title	:	Gender Equality in Science, Technology, Engineering, Art and Mathematics
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Project Acronym	:	GE-STEAM
Project Start Date	:	01-10-2020
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Project's Partners

C.C.D. MUREȘ

Centrul de Limbi Moderne Professional Language Centre

Първо частно училище "Леонардо да Винчи"

Future In Perspective

POSTAL 3

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CHAPTER ONE:

OVERVIEW OF THE PROJECT

INTRODUCTION

WHY GE-STEAM PROJECT?

The promotion of gender equality in and through education is a prerequisite to the achievement of equality between women and men in all spheres of life in society. The Council of Europe has promoted gender equality and non-stereotyped education at all levels. By shaping gender representations, attitudes and behaviours, early education is an essential factor to combat stereotypes and bring about social and cultural changes. Gender mainstreaming will play an active part in implementing awareness-raising and training on gender equality. Policymakers and educators worldwide should not underestimate the importance of early childhood education on the development of deeply engrained gender norms. It is important to consider the cognitive and affective formation of gender identity which develops in early childhood. The types of skills, personality attributes, and career aspirations learned through teacher-child interactions and childhood play can form stereotypical masculine and feminine attitudes toward gender roles, which develop before adolescence. By associating gender equality and STEAM focused on pre-school, primary and junior secondary education the project addresses the underrepresentation of girls in STE(A)M (Science, Technology, Arts, Engineering and Mathematics) who will be the future women in STE(A)M careers.

WHAT IS THE OBJECTIVE?

This project is concerned with gender equality in pre-school, primary and lower secondary education and aims at contributing to increased capabilities to reduce stereotypes by developing a series of innovative and interactive materials, tested through a behavioural science lens for their potential to increase equality by amendment of practical everyday skills and social norms regarding attitudes and stereotypes, especially in STEAM and in what concerns teachers and youngsters.

WHICH ARE THE OBJECTIVES?

- Define unconscious biases and gender stereotypes in pre-school, primary and secondary STEAM education by raising awareness of target groups;
- Support pre-school, primary and lower-secondary school teachers by providing them training, materials to deal with diversity and gender-balance in their classrooms (e. g. helping them to design suitable education programmes, organise hands-on activity, promoting equality in STEAM and mentoring ...) and then engage more girls in STEAM education;
- Create a friendly ECOSYSTEM in class where girls in early education will feel appreciated and motivated to participate in STEAM activities as equals both in number and in terms of responsibilities.

The methodology used is that based on a behavioural sciences methodological framework. According to current reports, we can fully act on this age range to engage more girls in STEAM education. Behavioural Insight is a process that looks at Behaviours, Analysis, Strategies, Interventions, Change (BASIC). This approach will allow the project partners to get to the root of the problem (gender stereotyping and bias), gather evidence on what works, show support for

innovation, and ultimately improve the situation. The testing will involve 75 teachers; Peer-mentoring 40 mentors and 40 mentees; 30 Business Mentors and 1124 children/pupils. The evaluation of the actual impact on teachers, decision makers and pupils should be done by discouraging a specific behaviour towards gender balance especially in STEAM subjects. Before-after self-assessment questionnaires, using the exact same target group can show us the amount of change in their behaviour. Adding intersectionality allows the fight for gender equality to become inclusive. Priority will be given to actions that help address diversity and promote –in particular through innovative and integrated approaches– ownership of shared values, equality, including gender equality, and social inclusion.

Ensuring girls and women have equal access to STEM education and ultimately STEM careers is an imperative from the human rights, scientific, and development perspectives.

Equality in Science, Technology, Engineering, Art and Mathematics (E-STEAM) focuses on primary, junior and upper-secondary, VET and non-VET teachers by developing a gender-sensitive interdisciplinary approach in class. It addresses the underrepresentation of girls in STE(A)M (Science, Technology, Arts, Engineering and Mathematics) who will be the future women in STE(A)M careers.

EIGE's study on the economic benefits of gender equality (2017a) shows that reducing gender segregation in STEM education alone could lead to an additional 1.2 million jobs in the EU. These jobs are estimated to occur mostly in the long term, however, as employment is likely to be affected only after new women STEM graduates choose to work in the STEM fields. In parallel, higher productivity associated with these STEM jobs is likely to result in higher wages for newly graduated women – affecting the gender pay gap as well as income and living standards of women, men, children and their extended families (European Parliament, 2015a).

To treat one group preferentially based on gender is seen as morally wrong; it seems downright irresponsible to ignore half the population when there is a skill shortage. Whatever argument you choose: ethical, pragmatic or philosophical it is clear that the STEAM fields cannot continue to ignore and be under representative of such a huge sector of the population both at national and European level.

WHAT PREVENTS GIRLS FROM CHOOSING STEAM?

Most of all cultural traditions and stereotypes. Stereotypes are insidious things and can manifest themselves in various ways, but one of the most damaging ways stereotypes can affect girls is through the implicit biases carried by their teachers.

WHICH ARE THE OBJECTIVES?

The project aims to:

I. establish synergies among schools and the labour market towards creative and meaningful engagement of girls in STEAM education (through a mentoring programme)

II. develop a virtual platform as a resource hub for practical and innovative learning solutions complementing schools' curricula

III. exploit and disseminate personalised activities by promoting the use of the platform

WHO ARE THE USERS?

The project will target 3 groups:

1. Teachers in Pre-Primary, Primary and Lower Junior education and especially teachers in STE(A)M, career advisors;

2. Decision makers, Policy formulators, Head teachers, school directors, teacher' training centres, representatives of regional/national and EU authorities.

3. Students/pupils 5+ (to engage more girls in STEAM careers).

WHY THIS TRAINING PROGRAMME?

Today's students will grow up to fulfill careers that do not exist yet. Today, more than ever, it is crucial to prepare our students to become future-ready and have the confidence to invent the world they want to live in. To do this, we must equip them with 21st century skills (critical thinking, creativity, collaboration, communication) and STEAM - Science, Technology, Engineering, Art, and Math - knowledge so they can be prepared for future challenges. Although some research shows that educational institutions have not kept pace with the changing nature of work, we hope to see an increasing number of schools now assimilating STEAM into their programmes - either fully integrated as part of core academic subjects or offered as part of after school and extracurricular activities.

As a result, we were able to delve more deeply into the types of programmes that are offered as part of STEAM education, and some of the best practices to ensure an effective and engaging implementation for the early education sector.

Following, you will find the results of this project, along with actionable strategies for school educators to start and scale their STEAM programmes.

FRAMEWORK /CURRICULUM FOR 21ST CENTURY LEARNING

It defines four unique learning and innovation skills with an emphasis on "4Cs": critical thinking and problem solving, creativity and innovation, communication, and collaboration. These skills help children prepare for the increasingly complex and unknown work environments of the future.

To think ***creatively***, children must call upon a wide range of idea creation and brainstorming techniques to create new ideas, then elaborate, refine, analyze, and evaluate those ideas. And they cannot do it alone; creativity is almost never undertaken solo. Children need to be able to work with others to develop and ***communicate*** new ideas effectively, be receptive to different perspectives, and integrate various ideas to create more effective and complete solutions for the problems they care about. Most importantly, creativity does not stop at idea creation. Students need the opportunity to ***act on their ideas***, take risks, make mistakes, learn from their failures, and continuously improve their inventions through a cyclical process. These 21st century skills are the cornerstones of STEAM education which describes a problem - and a ***project-based approach*** to learning that involves hands-on, collaborative, and active involvement of children in finding solutions to authentic problems they care about.

WHAT IS THE CULTURE OF STEAM EDUCATION?

The culture of STEAM education is built around collaboration and peer-to-peer interactions; it emphasizes the process of making rather than the final product. It often involves an interdisciplinary approach to instruction and learning: ***STEAM educators*** integrate visual arts, music, language arts, humanities, and social sciences into STEAM projects, giving students a chance to have a holistic experience with technology.

Importantly, the goal of STEAM education is not to turn every student into a programmer or an engineer. The world needs diversity, after all. Instead, STEAM education is meant to give every child an opportunity to learn about the technologies they use and to help them identify themselves as innovators and change makers that are capable of taking an active role in inventing solutions for problems they care about.

HOW CAN STEAM EDUCATION WORK WITH EXISTING CURRICULUM?

STEAM education provides opportunities for children/students to deepen their understanding of academic subjects such as arts, mathematics, sciences, language arts, and social studies. Through hands-on project-based learning, students will demonstrate what they know, reflect on their understanding and misunderstanding, and share their knowledge with the community.

The bottom line? If implemented in a meaningful and effective way, STEAM activities add to students' learning of core subject areas and never take away time.

The Invention Cycle has four easy to follow steps that help students solve an engineering problem:

1. **CREATE**: Brainstorm ideas, explore potential materials, and create a first model or prototype.

2. **PLAY**: Test your prototype to identify what's working well and what needs to be improved.

3. **REMIX**: Improve or change your prototype to better solve the problem.

4. **SHARE**: Communicate your process, ideas and final project.

WHY STEAM EDUCATION?

By adding art into STEM education (STEM + A = STEAM), not only are we making the programme relatable to more children both girls and boys, but we are also giving them the opportunity to engage in creativity and to express themselves through their projects while tinkering, making, sharing, and playing.

HOW TO USE STEAM ACTIVITIES?

There are three main questions in educators' minds when planning an effective STEM/ STEAM programme:

(1) WHERE TO START,
(2) WHAT ARE THE BEST IMPLEMENTATION STRATEGIES
for an effective and accessible STEAM programme, and
(3) HOW TO SCALE.

1.WHERE DO I START?

Many successful programmes start with one enthusiastic teacher, educator or media specialist who believes in the power of STEAM. These educators take an active role

in introducing hands-on project based engineering, coding, and robotics into their schools. Here are some characteristics of successful STEAM proponents: for more information watch this video: https://www.youtube.com/watch?v=9JY2vuxdWnU

1.1.START SMALL

From a simple challenge for the students in their classroom or a project educators need to make sure they have the buy-in required from their schools and districts to be successful. They understand that students may take some time to get used to the programme, so they carefully examine what works and what might need some tweaking before they take on larger projects. Then, they work their way up to more complex implementations and lessons.

1.2. START SIMPLE

Successful STEAM programmes keep it simple and they make use of tools and materials with which kids are already comfortable. By integrating interesting technology that is accessible to everyone, is easy to use, and can be integrated with other crafts materials in their classroom or library, they can help ease students, other educators, and administrators into STEAM.

1.3. START AND FAIL FAST, IMPROVE, AND KEEP ON GOING

Failing fast and forward is interwoven with maker and STEAM education culture. Educators who take an active role in starting STEAM programmes embrace this culture by trying different tools and programmes, failing, and learning from their failures. This cycle of invention encourages them to try new methods and ultimately come up with a solution that works for them.

WHAT ARE THE BEST IMPLEMENTATION STRATEGIES?

Every successful STEAM programme should be accessible to every student, no matter their background, gender, or comfort level with the technology. The key is to implement tools that have "low floors," meaning they are easy to pick up and start using without the need for extensive training.
These tools should also be gender inclusive and instead of dictating what girls or boys should like, allowing students to bring their own characters and personalities into their projects.

https://www.youtube.com/watch?v=vSAXJCPC5C4 TIME:2'47"

IMPLEMENT TOOLS THAT ARE CROSS-PLATFORM, REUSABLE, AND CAN BE INTEGRATED WITH OTHER MATERIALS

An important element of creative thinking is being able to come up with new ways to use the tools and objects around us. Therefore, the materials we choose for our maker space and STEAM programmes should allow for remixing, taking apart, reusing, and repurposing.

HOW CAN YOU SCALE YOUR STEM / STEAM PROGRAMME?

Unfortunately, many innovative STEAM practices start – and stop – with a lead educator. To fully immerse an entire school or

district in maker and STEAM education, lead educators need the buy-in from their admins, and admins need the buy-in from all their teachers, even teachers who are not tech-savvy.

Here are a few practical tips to help educators get buy-in across the whole school or even a district.

CREATE A CULTURE AROUND STEAM

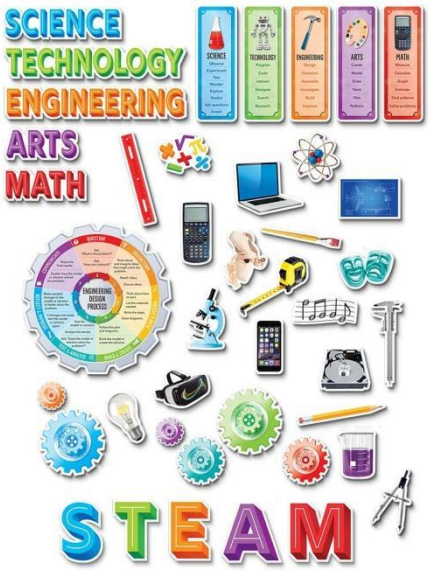
Many lead educators who successfully scale their innovative practices have done so by creating a movement behind their initiative. Having an end-of-the-year competition across the school, showcasing students' projects at various school events, and celebrating students and teachers who make a difference in STEAM every day are great ways to cultivate the culture of making and innovating.

PROVIDE RESOURCES FOR PROFESSIONAL DEVELOPMENT

Teachers are on the front lines every day -- responsible for training students for the future of work. Often, these teachers have not had any formalized STEAM training, themselves. Principals and district admins can set these teachers up for success by ensuring that any STEAM programme they are looking to integrate includes professional development. The more teachers know, the more effectively they will be able to instruct kids.

MAXIMIZE COLLABORATION OPPORTUNITIES AMONG TEACHERS AND STEAM SPECIALISTS

Educators love to share their knowledge and are keen to hear from other educators about best practices. That's a great opportunity for school and district admins to facilitate ways for their lead tech-savvy educators to share their success stories with STEAM and spread the excitement among their colleagues.



STEAM implementation, includes four levels of INTEGRATION:

- Integration of STEAM topics within STEAM courses or extracurricular activities
- Integration of STEAM into all subjects within a specialized programmer
- Integration of STEAM as part of all subject areas throughout the school – but not necessarily using a whole-instruction approach for problem-based learning
- Problem-based learning and STEAM integration defines the instruction model for all subjects in the school and the mindset transcends beyond
- The school boundaries into the community at large.

Whether you are an enthusiastic educator taking an active role in introducing STEAM and coding into your school, or a leader accepting the challenge to scale a successful implementation beyond one classroom and into a whole school or district, it is important to plan not only for the tools, but also for professional development, and integration into core subject areas, extracurricular activities, and after school programs.

Video: https://www.youtube.com/watch?v=fiiox73jn2w Time:2c

CAN STEAM BE CONSIDERED A TEACHING METHOD?

Education in the 21st century, which has entered a disruptive 4.0 digital era, must continue to innovate. Early childhood education, as one of the knowledge institutions, must also be prepared to answer the challenges of this era. This type of education needs to make changes to both curriculum and learning methods. STEAM learning is considered to integrate the skills needed by children. STEM encourages children to build knowledge about the world around them by observing, investigating and asking questions. The addition of 'Arts' (leading to the STEAM acronym), will give children the opportunity to describe the STEM concept in creative and imaginative ways. This review finds a definition for 'A' or 'Arts' in STEAM showing that the making of art and the creative process is overshadowed by the emphasis on the final result or product. For example, a study by Perignat and Katz-Buonincontro (2019) explains that students use various techniques to solve problems and demonstrate learning, and this includes attention to the humanities (the 'A' in STEAM) because they created media art and short videos written to present their solution. The impact of this learning is that STEAM makes children more active and able to take initiatives with their own knowledge, and teachers who are influenced by the integrated professional development of STEM prompt children to be positively influenced by their teacher's professional learning.

Another finding from this review is that experience of STEAM can increase self-confidence in children International Journal of Pedagogy and Teacher Education (IJPTE) (Vol. 4 Issue 1 | April 2020) ISSN: 2549-8525 | p-ISSN: 2597-7792 Page | 41

CONCLUSION

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https://youtu.be/ZImpuLyt4ew

Insights and tips for the adoption of STEAM in your school Time: 10.21

STEAM is an integrated approach to learning which requires an intentional connection between curriculum objectives, assessments, and lesson design/implementation.

To develop a successful programme, schools must consider a variety of factors, including:

- collaborative planning, including a
- cross-section of teachers on each team
- adjusting timetables to accommodate a new way of teaching and learning
- professional development for all staff in STEAM practices and principles
- STEAM mapping for the curriculum and assessment design process
- alignment and unpacking of standards and assessments
- seamless lesson implementation processes and strategies.

A STEAM lesson addresses all or most of the following components

- The lesson contextualises maths, science, and art.
- The lesson is collaborative.
- The lesson results in a technology that solves a real-world problem.
- The lesson allows for multiple solutions (there isn't one right answer to arrive at).
- The lesson is hands-on and artistic.

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I. **GE-STEAM platform prototype.**

II. The **Test** is the final stage which must be considered as an interactive process, so that the results generated during the testing phase are often used to redefine one or more problems and inform the understanding of the users, the conditions of use, how people think, behave, and feel, and to empathize. After pilot sessions in O5, this stage results in the intellectual outputs 6: - Exploitation guidelines.

CHAPTER TWO:

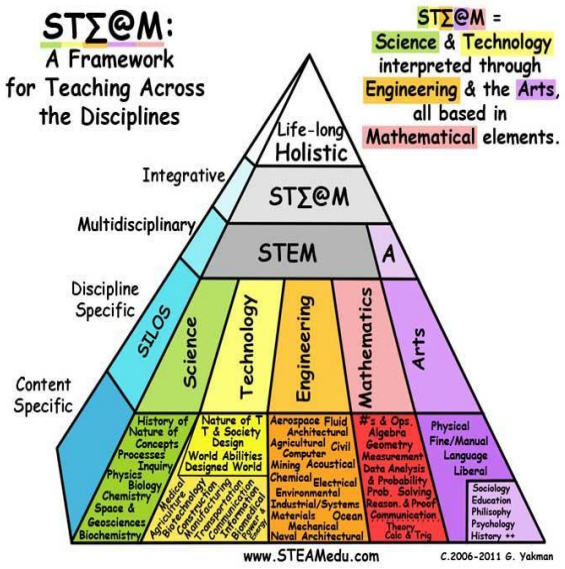
CURRICULUM

WHAT KIND OF THE TRAINING PROGRAMME?

It will be a highly participatory and experiential course (TP). Although there will be a general course design, on the whole it will be a process course in which the facilitator(s) respond constantly to the ongoing needs and wants of the participants. Participant feedback will therefore be a major course design component, which will affect subsequent course planning.

The idea of the course is that education should be a personal journey which the learner can shape.

The main methodology used will be: personalised learning.



WHAT IS PERSONALISED LEARNING?

Personalised learning demands teaching and learning strategies that develop the competence and confidence of every learner.

1. For students it means a focus on their repertoire of skills and their management of the learning experience.
2. Personalised learning requires a range of whole class, group and individual teaching, learning and ICT strategies to transmit knowledge, to instill key learning skills and to accommodate different paces of learning.
3. Personalised learning is not just about giving learners more choice. It means engaging learners in a highly interactive process of learning. Learning is not just the successful transfer of knowledge and skills. Learning comes through interaction in which the learner discovers for themselves, reflects on what they have learned and how. Effective learning has to be co-created between learner and trainer in which both invest effort and imagination.

4. ICT should be a tool for everyone to use in every lesson. Information technology creates a shared platform for learning, linking home and community, in which learners and trainers work together far more collaboratively. That is the way leading edge businesses already operate.
5. Curriculum's components

For more information watch the video: https://www.youtube.com/watch?v=6oLNLCO0vfI Time: 2.27

WHICH ARE THE LEARNING OUTCOMES?

By the end of the course, participants should:

a) have made explicit and shared their own beliefs, attitudes and feelings about STEAM teaching through personalized learning, together with the impact of the course on their own activity

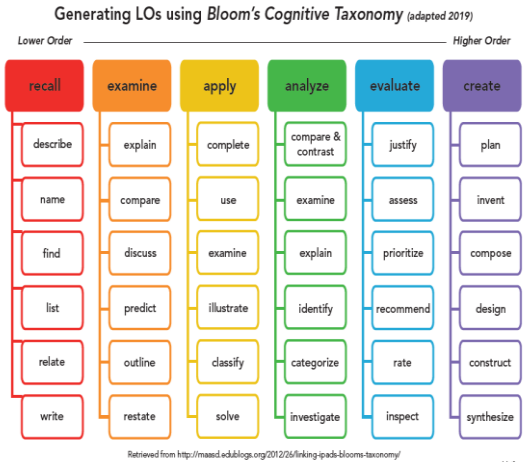
b) have knowledge about:

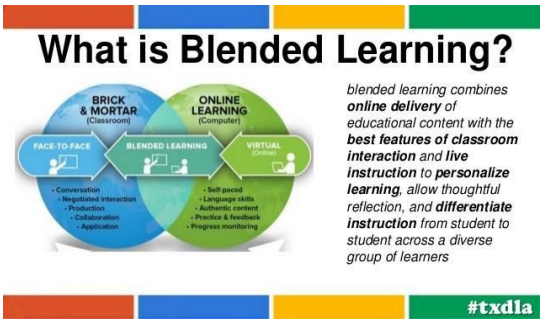
- concepts of STEAM related to their future career option
- the role of teacher in personalized learning (facilitator)
- counseling and mentoring techniques
- observation, observation tools and recording methods
- training styles and possible impacts (personalized learning)
- a wide range of activities and procedures for enabling girl-students acquire the needed skills
- assessment and evaluation: criteria, tools, processes
- a range of tools and activities for girls own development

c) have practised skills and attitude in

- relationship management: forming, maintaining and ending
- active listening
- sensitive language use in counseling discussions
- assessing individual needs in order to select appropriate intervention style and activity, or provide concrete practical help
- helping girls become capable of independent self-evaluation
- assessing and evaluating girls work against the contextually accepted standard
- some tools and activities for their own development

The course will be a B-learning TP and will have two parts: a face to face one (12 classes) and an online part (30 classes) or totally on-line 21 sessions. For more information watch the video with Bloom's Taxonomy: https://www.youtube.com/watch?v=OOy3m02uEaE





CHAPTER THREE:

THE TRAINING PROGRAMME 'S METHODOLOGY

Constructivist approach teaching methods are based on constructivist learning theory.

Alongwith John Dewey, Jean Piaget researched childhood development and education. Both Dewey and Piaget were very influential in the development of informal education. Dewey's idea of influential education suggests that education must engage with and enlarge experience and the exploration of thinking and reflection associated with the role of educators. Piaget's role in the constructivist teaching suggests that we learn by expanding our knowledge by experiences which are generated through play from infancy to adulthood which are necessary for learning. Their theories are now encompassed in the broader movement of progressive education. Constructivist learning theory says that all knowledge is constructed from a base of prior knowledge. Children are not a blank slate and knowledge cannot be imparted without the child making sense of it according to his or her current conceptions. Therefore, children learn best when they are allowed to construct a personal understanding based on experiencing things and reflecting on those experiences.

WHAT ARE THE CHARACTERISTICS OF THE CONSTRUCTIVIST THEORY?

One of the primary goals of using constructivist teaching is that students learn how to learn by giving them the training to take initiative for their own learning experiences. According to Audrey Gray, the characteristics of a constructivist classroom are as follows:

- the learners are actively involved
- the environment is democratic
- the activities are interactive and student-centered
- the teacher facilitates a process of learning in which students are encouraged to be responsible and autonomous

EXAMPLES OF ACTIVITIES

Furthermore, in the constructivist classroom, students work primarily in groups and learning and knowledge are interactive and dynamic. There is a great focus and emphasis on social and communication skills, as well as collaboration and exchange of ideas. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook. Some activities encouraged in constructivist classrooms are:

- **Experimentation:** Students individually perform an experiment and then come together as a class to discuss the results.
- **Research projects:** Students research a topic and can present their findings to the class.
- **Field trips:** This allows students to put the concepts and ideas discussed in class in a real-world context. Field trips would often be followed by class discussions.
- **Films:** These provide visual context and thus bring another sense into the learning experience.
- **Class discussions:** This technique is used in all of the methods described above. It is one of the most important distinctions of constructivist teaching methods.

CONSTRUCTIVIST THEORY AND ONLINE LEARNING

Constructivist approaches can also be used in online learning. For example, tools such as discussion forums, wikis and blogs can enable learners to actively construct knowledge.

WHICH ARE THE CHARACTERISTICS OF TRADITIONAL CLASS VERSUS CONSTRUCTIVIST CLASS

A contrast between the traditional classroom and the constructivist classroom is illustrated below:

The Traditional Classroom

Begins with parts of the whole – emphasizes basic skills. Strict adherence to fixed curriculum Textbooks and workbooks Instructor gives/students receive, Instructor assumes directive, authoritative role, Assessment via testing / correct answers. Knowledge is inert Students work individually.

The Constructivist Classroom

- Begin with the whole – expanding to parts
- Pursuit of student questions / interests
- Primary Sources / manipulative materials
- Learning is interaction – building on what students already know
- Instructor interacts / negotiates with students.
- Assessment via student works, observations, points of view, tests. Process is as important as product.
- Knowledge is dynamic / change with experiences
- Students work in groups

Source: Thirteen Ed Online (2004)

Because existing knowledge schemata are explicitly acknowledged as a starting point for new learning, constructivist approaches tend to validate individual and cultural differences and diversity.

WHAT IS THE ROLE OF TEACHERS?

In the constructivist classroom, the teacher's role is to prompt and facilitate discussion. Thus, the teacher's main focus should be on guiding students by asking questions that will lead them to develop their own conclusions on the subject.

Parker J. Palmer (1997) suggests that *"good teachers join self, subject, and students in the fabric of life because they teach from an integral and undivided self, they manifest in their own lives, and evoke in their students, a capacity for connectedness*".

David Jonassen identified three major roles for facilitators to support students in constructivist learning environments:

I. Modeling
II. Coaching
III. Scaffolding

A brief description of the ***Jonassen major roles*** are:

Modeling – Jonassen describes Modeling as the most commonly used instructional strategy. Two types of modeling exist: behavioural modeling of the overt performance and cognitive modeling of the covert cognitive processes. Behavioral modeling in Constructivist Learning Environments demonstrates how to perform the activities identified in the activity structure. Cognitive modeling articulates the reasoning (reflection-in-action) that learners should use while engaged in the activities.

Coaching – For Jonassen the role of coach is complex and inexact. She acknowledges that a good coach motivates learners, analyzes their performance, provides feedback and advice on the performance and how to learn about how to perform, and provokes reflection and articulation of what was learned. Moreover, she posits that coaching may be solicited by the learner. Students seeking help might press a "How am I Doing?" button. Or coaching may be unsolicited, when the coach observes the performance and provides encouragement, diagnosis, directions, and feedback. Coaching naturally and necessarily involves responses that are situated in the learner's task performance (Laffey, Tupper, Musser, & Wedman, 1997).

Scaffolding - Scaffolding is a more systemic approach to supporting the learner, focusing on the task, the environment, the teacher, and the learner. Scaffolding provides temporary frameworks to support learning and student performance beyond their capacities. The concept of scaffolding represents any kind of support for cognitive activity that is provided by an adult when the child and adult are performing the task together (Wood & Middleton, 1975) similar to **Mentoring**.

Constructivist learning environments (CLEs)

Jonassen has proposed a model for developing constructivist learning environments (CLEs) around a specific learning goal. This goal may take one of several forms, from least to most complex:

- Question or issue
- Case study
- Long-term Project
- Problem (multiple cases and projects integrated at the curriculum level)

Jonassen recommends making the learning goals engaging and relevant but not overly structured.

In CLEs, learning is driven by the problem to be solved; students learn content and theory in order to solve the problem. This is different from traditional objectivist teaching where the theory would be presented first and problems would be used afterwards to practice theory.

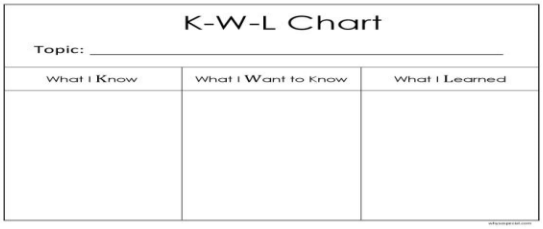
Depending on students' prior experiences, related cases and scaffolding may be necessary for support. Instructors also need to provide an authentic context for tasks, plus information resources, cognitive tools, and collaborative tools.

ASSESSMENT

Traditionally, assessment in the classrooms is based on testing. In this style, it is important for the student to produce the correct answers. However, in constructivist teaching, **the process of gaining knowledge** is viewed as being just as important as the product. Thus, assessment is based not only on tests, but also on observation of the student, the student's work, and the student's points of view.

Some assessment strategies include: **Oral discussions**. The teacher presents students with a "focus" question and allows an open discussion on the topic.

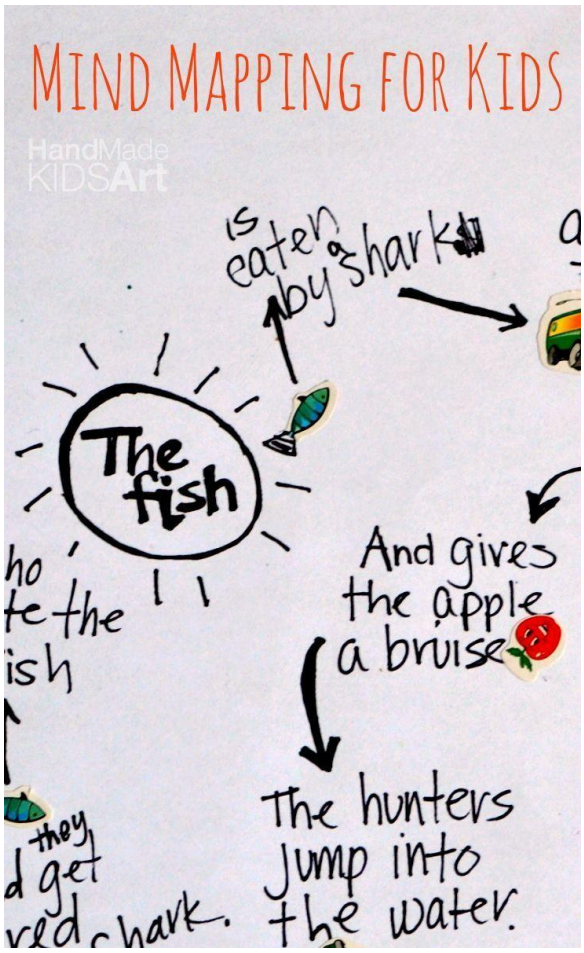
KWL(H) Chart (What we know, What we want to know, What we have learned, How we know it). This technique can be used throughout the course of study for a particular topic, but is also a good assessment technique as it shows the teacher the progress of the student throughout the course of study.


K-W-L Chart

Topic: _____

What I Know	What I Want to Know	What I Learned

Mind Mapping
In this activity, students list and categorize the concepts and ideas relating to a topic.



Hands-on activities. These encourage students to manipulate their environments or a particular learning tool. Teachers can use a checklist and observation to assess student success with the particular material.
Pre-testing. This allows a teacher to determine what knowledge students bring to a new topic and thus will be helpful in directing the course of study.

SPECIFIC APPROACHES TO EDUCATION BASED ON CONSTRUCTIVISM

An approach to learning based on the constructivist learning ideologies presented by Jean Piaget (Harel & Papert, 1991). In this approach, the individual is consciously engaged in the construction of a product (Li, Cheng, & Liu, 2013). The utilization of constructionism in educational settings has been shown to promote higher-order thinking skills such as **problem-solving and critical thinking** (Li et al., 2013).

WHICH ARE THE GUIDED INSTRUCTIONS?

A learning approach in which the educator uses strategically placed prompts, cues, questions, direct explanations, and modeling to guide student thinking and facilitate an increased responsibility for the completion of a task (Fisher & Frey, 2010).

WHAT IS PROBLEM BASED LEARNING?

A structured educational approach which consists of large and small group discussions (Schmidt & Loyens, 2007). **Problem-based learning** begins with an educator presenting a series of carefully constructed problems or issues to small groups of students (Schmidt & Loyens, 2007). The problems or issues typically pertain to phenomena or events to which students possess limited prior knowledge (Schmidt & Loyens, 2007).

The first component of problem-based learning is to discuss prior knowledge and ask questions related to the specific problems or issues (Schmidt & Loyens, 2007). Following the class discussion, there is typically time in which students individually research or reflect on the newly acquired information and/or seek out areas requiring further exploration (Schmidt & Loyens, 2007).

After a pre-determined amount of time (as outlined by the educator), students will meet in the same small groups that were composed prior to the class discussion (Schmidt & Loyens, 2007).

In the first meeting, groups will spend between one and three hours further

discussing the problems or issues from class in addition to presenting any new information collected during individual research (Schmidt & Loyens, 2007). Following the first meeting, students will independently reflect on the group discussion, specifically in comparing thoughts regarding the problems or issues in question (Schmidt & Loyens, 2007).

Typically, groups will meet a second time to critically analyse individual and group thoughts and discussions and will attempt to synthesize the information in order to draw conclusions about the given problem or issue (Schmidt & Loyens, 2007).

Within the educational setting, problem-based learning has enabled students to actively construct individual understandings of a topic using both prior and newly acquired knowledge (Schmidt & Loyens, 2007). Moreover, students also develop self-directed and group learning skills which ultimately facilitates the comprehension of the problems or issues (Schmidt & Loyens, 2007).

WHAT IS INQUIRY BASED LEARNING?

An educational approach associated with problem-based learning in which the student learns through investigating issues or scenarios (Hakverdi-Can & Sonmez, 2012). In this approach, students pose and answer questions individually and/or collaboratively in order to draw conclusions regarding the specific issues or scenarios (Hakverdi-Can & Sonmez, 2012).

Within the educational setting, **inquiry-based learning** has been beneficial in developing student inquiry, investigation, and collaboration skills, in turn, increasing overall comprehension of the issue or scenario (Hakverdi-Can & Sonmez, 2012).

Effective essential questions include student thought and research, connect to student's reality and can be solved in different ways (Crane, 2009). There are no incorrect answers to essential questions, rather answers reveal student understanding (Crane, 2009).

WHAT IS ANCHORED INSTRUCTION?

An educational approach associated with problem-based learning in which the educator introduces an 'anchor' or theme in which students will be able to explore (Kariuki & Duran, 2004). The 'anchor' acts as a focal point for the entire task, allowing students to identify, define, and explore problems while exploring the topic from a variety of different perspectives (Kariuki & Duran, 2004).

WHAT IS COOPERATIVE LEARNING?

A variety of educational approaches focusing on individuals working together to achieve a specific learning outcome (Hsiung, 2012).

WHAT IS RECIPROCAL PEER TEACHING?

A **cooperative learning** approach wherein students alternate roles as teacher and learner (Krych, March, Bryan, Peake, Wojciech, & Carmichael, 2005).

The utilization of **Reciprocal Peer Teaching (RPT)** in educational settings has been effective in the development of teamwork, leadership, and communication skills in addition to improving students' understanding of course content (Krych et al., 2005).

WHAT IS JIGSAW LEARNING?

A highly structured cooperative learning approach which is implemented in four stages: introduction, focused exploration, reporting and re-shaping, and integration and evaluation. In the introduction stage, the class is divided into heterogeneous 'home' groups consisting of between three and seven students (Karacop & Doymus, 2013).

Upon establishing the 'home' groups, the teacher will discuss the subtopics pertaining to the subject matter (Karacop & Doymus, 2013). In the focused exploration stage, each student within all 'home' groups selects one of the subtopics (Karacop & Doymus, 2013).

Students from each 'home' group that have selected the same subtopic will form a 'jigsaw' group (Karacop & Doymus, 2013).

It is in the 'jigsaw' group that students will explore the material pertaining to the subtopic and will prepare for teaching it to their 'home' group, the reporting and re-shaping stage (Karacop & Doymus, 2013).

The approach concludes in the fourth stage, integration and evaluation, wherein each of the 'home' groups combine the learning of each subtopic together to create the completed piece of work (Karacop & Doymus, 2013).

If you want to know more go to this video: *Curriculum Development and Course Design*

https://slideplayer.com/slide/1585514/

WHAT IS PROJECT BASED LEARNING?

- Project-based learning can target one or more content areas.

- We may start small with our target group teachers in their first implementations and pick only a couple of content areas to target. However, as teachers and students become more PBL-savvy, STEAM can be a great opportunity to create a project that hits science, math, technology, and even art content.

- You could also integrate science, art, and a foreign language, for example—you're not limited to the subjects in the STEAM acronym.

- For more information watch this video: https://www.youtube.com/watch?v=LMCZvGesRz8&feature=youtu.be

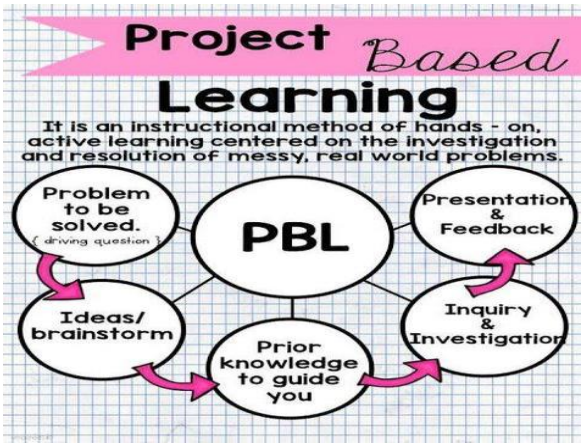
- **https://pt.slideshare.net/JessicaLura/deeper-learning-through-projectbased-learning-and-steam**

PBL can teach and assess the 21st-century skills embedded in STEAM
Skills like:

- collaboration,
- creativity,
- critical thinking,
- problem solving

are part of any STEAM PBL, and will be needed for students to be effective.

- 21st-century skills are part of **the glue of STEAM education**.



CHAPTER FOUR:
STEREOTYPES & COUNTER ARGUMENTS

ORGANISING A WORKSHOP - A SPRINGBOARD FOR HIGHLIGHTING STEREOTYPES

"The OECD pinned the blame for the disadvantage for girls in maths and science on low expectations among parents and teachers, as well as lack of self-confidence and what it called the ability to "think like a scientist" in answering problems".

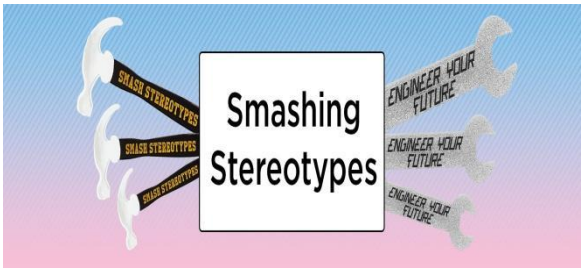
Workshops for spotting unconscious and conscious stereotypes are paramount to assure a springboard for the Training Programme. Facilitating a Gender Sensitive Training Workshop can be challenging in terms of handling a situation when a heated debate starts to take place. The tension in a sensitive debate can be eased when a facilitator is able to emphasize facts instead of opinions. That being said, both facts and opinions should be welcomed as part of an engaging and fruitful group discussion.

An essential skill of a trainer is to overcome biases and de-escalate sensitivities by noticing and addressing confusions between facts and views, without hurting the feelings of the concerned participants.

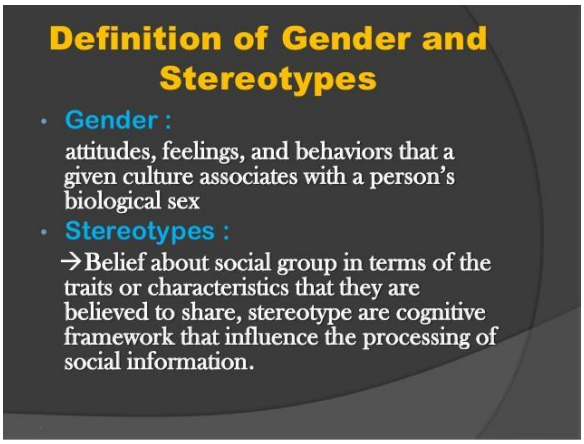
WHICH ARE THE THINGS TO CONSIDER?

There are many factors that encourage or inhibit people's participation such as language, experience related to the topic, and experience speaking in public, but also power relations related to people's social and economic position. Age and gender are also among the factors that may affect a person's capacity to be at ease speaking publicly. As workshop leader, you are able to identify potential issues at the start of the workshop in an effort to create a safe space for all the participants.

Target groups are indeed invited to participate in workshops and intellectual outputs production. They will have the opportunity to raise their awareness about the role they can play in contrasting gender stereotypes in STEAM education and contribute to the co-creation of a personalised and innovative solution, which will enable them to concretely change and improve their teaching- guidance and practices and make them more gender friendly. We hope that these directly involved beneficiaries will act as mentors and promoters of the solution within their own working environment and communities (teachers' networks and associations as well as virtual communities).



HERE ARE THE STEREOTYPES AND COUNTER ARGUMENTS WHICH WILL BE USED IN LESSON PLANNING



Stereotype I. Girls show an aptitude for art and humanities.

Counter Argument 1. Girls have the potential to excel in STEAM subjects.

CA2.There are many successful role models for girls in STEAM.

Stereotype II. Boys show an aptitude for how things work – linked to engineering work.

CA 1. Boys are given more opportunities to construct, build and fix things. (This is in the nature of toys they are encouraged to play with).

CA2. Many women work in engineering too. (There are still opportunities for girls to work in this sector).

Stereotype III. Girls like pink, boys like blue. Girls like glitter, boys like mud.

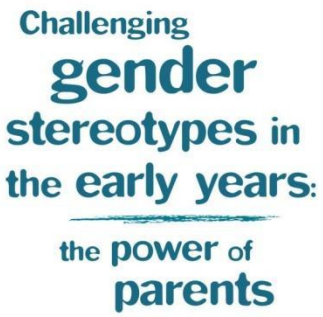
CA1. Colours are neutral. Society attributes gender characteristics to colours.

CA2. Girls like mud too - girls can enjoy activities that are often associated with action.

Stereotype IV. STE(A)M is not for girls.

CA1**:** Since the introduction of ART in STEM many opportunities open for girls.

CA2: There is a new (somehow imposed) attitude towards girls and women in STEAM career paths.

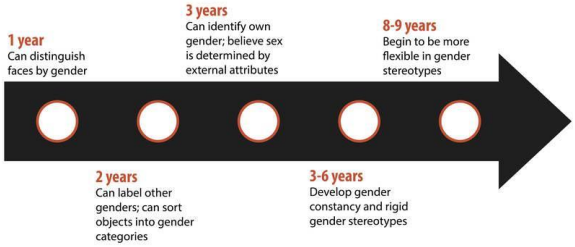


The stereotypes and counter arguments are used to develop the Training Programme, more concretely to design the Lesson Plans for teachers and students. The counter arguments will be the solutions for the designed activities. The evaluation and feedback of trainers, teachers, students or pupils will lead to improving and adjusting the TP in a most appropriate way for a maximum of impact.

Target groups are indeed invited to participate in workshops and intellectual outputs production. They will have the opportunity to raise their awareness about the role they can play in contrasting gender stereotypes in STEAM education and contribute to the co-creation of a personalised and innovative solution, which will enable them to concretely change and improve their teaching- guidance and practices and make them more gender friendly. We hope that these directly involved beneficiaries will act as mentors and promoters of the solution within their own working environment and communities (teachers' networks and associations as well as virtual communities).

Then at the end of the project the objective is that the learning solution (the personalised platform and training for teachers) to be promoted in curricula for teachers. That's why we also associate to the project, actors like the head of teachers, school directors, teachers' training centres, representatives of regional / national and EU authorities, STEAM mentors to promote the use of the project's solution.

The replication effect of target groups' involvement is expected to reach out thanks to local/national/regional and EU wide dissemination foreseen in workshops and multiplier events (E1 to E5) up to approximately 500 professionals by the end of the project.



GE-STEAM educates teachers and students in the early education sector, who are the final beneficiaries in the fields of science, technology, engineering, art and mathematics with an interdisciplinary approach, leading students to adapt to constantly changing professional knowledge and rapidly changing social life. STEAM education philosophy can be summarised as: based on mathematics, engineering and art interpret science and technology.

Taking into account users' needs and expectations, the process enhances the usability of the "*GE-STEAM Assistent*" platform and the associated "*GE-STEAM Training Programme*", fostering their appropriation by future users. This type of approach based on collaborative and user centric methods, is useful to guarantee that the solution well answers the stakeholders' needs.
It is time to put everything into practice and add the designed lesson plans for three different education level:

I. Pre-Primary Level: age 5+
II. Primary Level : 7+
III. Junior Secondary Level 10-12

CHAPTER FIVE:
STEAM RESOURCES FOR TEACHERS

MODULE ONE: PRE-PRIMARY EDUCATION

Pre-Primary level will include pupils 5+ in Kindergarten or preparatory and primary school. Our Bulgarian partner developed lesson plans specific to this level based on their experience in the first Private School Leonardo da Vinci in Ruse. Teachers interested in this level will be able to use these resources in their class in order to raise awareness among their pupils of equality of opportunities for all children from an early age.

This STEAM ***education*** *is fundamental to the development of a child and can significantly shape the later years of an individual's life.*

To illustrate this concept we can watch this educational short video:

https://www.youtube.com/watch?v=9rGkp8YJ7KE 4'18"

and use the lessons plans where needed.

Partner's description

The school is located on the right bank of the Danube River in the center of Ruse, the fifth largest city in Bulgaria, in a well-developed region.The school includes primary and secondary and upper-secondary education, so its students are between 5 and 19 years old. We also have a kindergarten of the same name - Leonardo da Vinci Kindergarten for children aged 2.5 years to preschool. Students include children from the city and the region, as well as children and young people of mixed or foreign origin, so they speak different languages, have different religions, come from different cultures and ethnicities. Our school has extensive experience in the application of interdisciplinary activities, such as fairy tales, games, drama, dance, sports, creative, environmental and artistic activities in the learning process.The school educates children in their first steps in gender equality from early years until today, as it has well-trained teachers and trainers from the University of Ruse. In the practical courses and seminars there are many parents who are specialists in their current field with specific professional skills, who participate in activities together with the students.For years the school has organized the Summer Academy where children aged 6-10 have the opportunity to apply their skills, talents and knowledge in mathematics, science, technology,Bulgarian, English while working on a wide range of topics (Pets, Healthy Eating, Danube, Earth, Friends, etc.). Since 2011 the school is a member of the international network "For a better school climate".

Lesson Plan One: Equality of professions

Learning Objectives:
Children will acquire knowledge and skills for:

- types of professions ,
- professional nature ,
- characteristics of the types of work ,
- the importance of work in human life .

the realization of self-determination / at the moment / in professional aspect / What do I want to be?/

Learning outcomes:
Knowledge:

- what is a profession ,
- what is gender tolerance ,
- what is a professional obligation ,
- what is professional equality

Skills:

- children acquire performance skills ,
- children acquire skills for gender tolerance ;
- children acquire skills for self-expression through professions ;
- children acquire skills for tolerant attitudes, without gender prejudices

Attitude:

- children work freely and use all means of communication ,
- children self-assess freely.

Stereotypes – Some professions are for girls, some are for boys
Counter Arguments – There are many examples of women working brilliantly male dominated professions, and vice versa**.**
This topic is intended to:

- to help children understand the role of gender in career development ,
- to build gender tolerance of people on the labor market / without gender restrictions /
- to break stereotypes related to male and female professions ,
- to develop the ability for self-determination / at the moment / in a professional aspect / What do I want to become? /

Guidelines for teachers

Description of the activities:
Discussion "What do I want to be when I grow up?"
The teacher draws the children's attention to the different types of professions and their professional characteristics.
Explains the possibility of practicing different professions without gender restrictions.
/ Discusses the film at the beginning of the lesson, emphasizing gender and professions in it /
The discussion is for the children to indicate for themselves whether a profession can be practiced by girls or boys. / Requires answers to be accompanied by arguments /
The children are given the opportunity to choose a profession for a girl and a boy. / With arguments/.
The children make a flash book with different professions.

Guidelines for piloting

The topic is useful for learning the ability to:

- creating conditions for fostering respect and good attitude towards people from different professions; development of the ability to work in a group ;

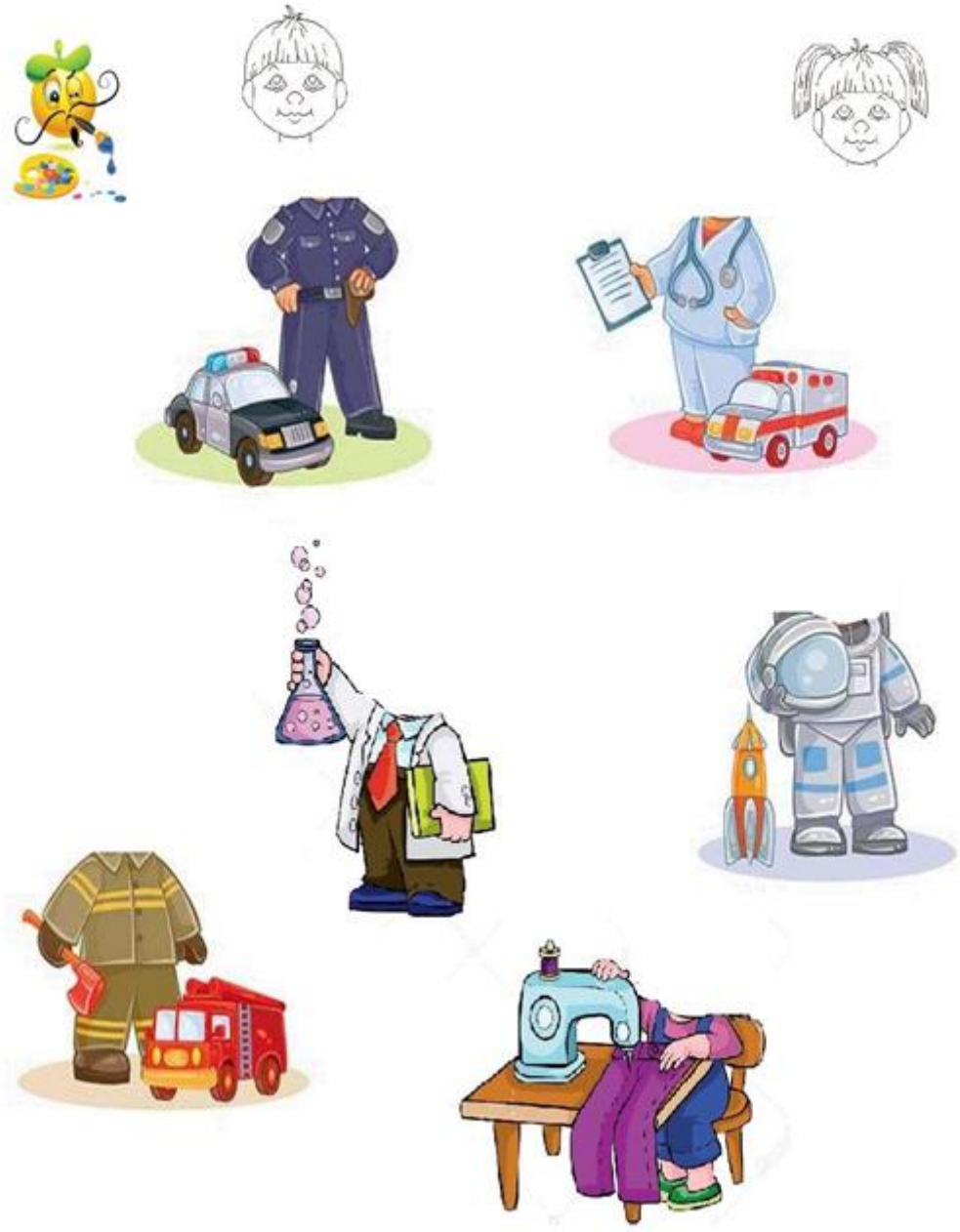
- Tolerance to the opinion of the partner ;
- Defense of one's own opinion through verbal argumentation.

Recommended duration: 20 – 30 minutes
Assessment/ Evaluation: We take into account the influence of gender in the self-expression of children and in their teamwork.
Materials, equipment: Used materials / on paper or electronic media /
Interactive whiteboard, multimedia, computer
Cardboard, scissors, coloured pencils
Resources:
https://www.youtube.com/watch?v=BfegL6UbX-0

Handouts

Professions for everyone /Worksheet for children 1/

Professions for everyone /Worksheet for children 2/



Professions for everyone /Worksheet for children 3/

Lesson Plan Two: Girls wear pink, boys wear blue

Learning Objectives:
The children will acquire knowledge and skills for:

- Self-analysis,
- Tolerance between age and gender,
- Development of their own colour perception,
- Development of aesthetic knowledge, without regard to gender

Constructiveness
Learning outcomes:
Knowledge:

- what is self-analysis;
- what is age and gender tolerance;
- what is colour perception;
- what is aesthetics;

Skills:

- children acquire skills for self-analysis;
- children acquire skills for gender and age tolerance;
- children acquire skills for self-expression through colours;
- children acquire skills for aesthetic combination of colours, without gender prejudices.

Attitude:

- children work freely and use all means of communication,
- children self-assess freely.

Stereotypes – Girls and boys should conform their outer appearance according to tradition.
Counter Arguments – Girls and boys should be free to express themselves and that does not hurt traditions.
This topic is intended to:

- to help children understand the role of gender in self-analysis,
- to build gender tolerance and the capacity for positive self-esteem,
- to break the stereotypes associated with male and female colours,
- to develop aesthetic knowledge, without regard to gender.

Guidelines for teachers

Description of the activities:
Discussion „How should people dress?"
/The teacher directs the children to the aesthetic side of personal appearance.
The teacher provides examples of "correct" and "incorrect" way to dress.
The teacher directs children towards aesthetic colour combination of clothes.
In the process of work, the lesson situation allows the children to "create" clothes and to dress a girl and a boy. The children make a STEAM project "Wind Carousel" from paper.

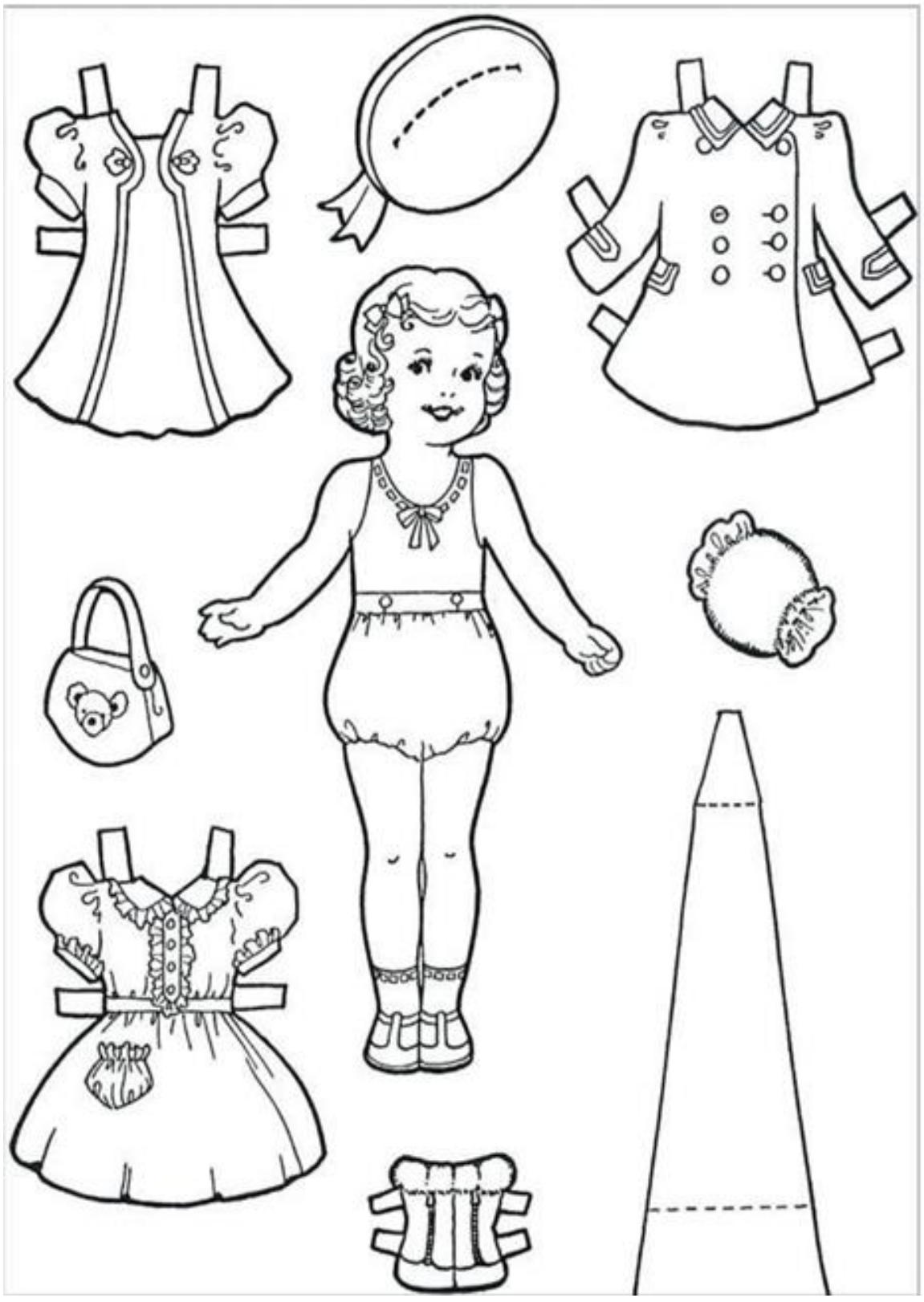
Guidelines for piloting

The topic is useful for mastering the ability for introspection, gender tolerance, age and self-confidence, inner colour perception.
Recommended duration: 20 – 30 minutes
Assessment/ Evaluation: We take into account the influence of gender in the self-expression of children and in their teamwork.
Materials, equipment: Used materials /on paper of electronic media/, interactive whiteboard, multimedia, computer, cardboard, scissors, coloured pencils.
Resources:
https://www.youtube.com/watch?v=Q_EwuVHDb5U

Colors? "Give them here."/Worksheet for children 1/

Colors? "Give them here."/Worksheet for children 2/

Colors? "Give them here."/Worksheet for children 3/



Lesson Plan Three: STEAM is for everyone

Learning Objectives:
Children will acquire knowledge and skills for :

- mastering the nature of things and the world around them, through STEAM,
- understanding the meaning of sensory experience (development of fine motor skills), regardless of gender.
- introduction to the technique and development of the child's creative activity in STEAM.

Learning outcomes:
Knowledge:

- what is STEAM;
- what is gender tolerance in STEAM professions;
- what is a professional obligation in STEAM;
- what is professional equality in STEAM.

Skills:

- children acquire performance skills;
- children acquire skills for sexual tolerance;
- children acquire skills for self-expression through the professions in STEAM;
- children acquire skills for tolerant attitudes, without sexual prejudices.

Attitude:
- children are free to work and use all means of communication,
- children self-assess freely.

Stereotypes&Counter Arguments – STEAM isn't for girls
Counter Arguments – There are many women in STEAM, with brilliant accomplishments and career, who can be perfect role models and inspiration.
This topic is intended for:
- support for children's research;
- eliminating the fear of "wrongdoing" in children;
- the formation of a sense of confidence, providing an opportunity to freely search for different opportunities to solve the problem;
- creating a wide research space in the group;
- encouraging experimental and exploratory activities for children;
- saturation of the educational process with various problem situations;
- carrying out educational activities based on needs and motives.

Guidelines for teachers

Description of the activities:
Discussion "What can we learn through STEAM?"
The children make a STEAM project "Wind Carousel" from paper.
The teacher explains:
What is STEAM?
What are the professions related to STEAM?
Does gender matter for STEAM-related occupations?
The children, independently, distribute the STEAM professions according to their gender.
The teacher provokes the children's creativity, giving them the task to complete the picture "Space" using geometric shapes.
/ The exercise can be done on an iterative board /

Guidelines for piloting

The topic is useful for learning the ability to:
- creating conditions for fostering openness to STEAM,
- development of the ability to work in a group;

- tolerance for the opinion of the children in the group;
- protection of one's own opinion through verbal argumentation .

Recommended duration: 20 – 30 minutes

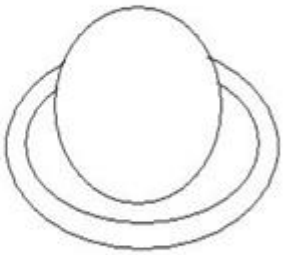
Assessment/ Evaluation: We take into account the influence of gender in the self-expression of children and in their teamwork.

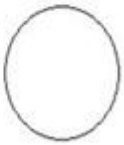
Materials, equipment: Used materials / on paper or electronic media /
Interactive whiteboard, multimedia, computer,
Cardboard, scissors, coloured pencils, coloured paper, wooden sticks, glue.

Resources:
OER https://www.youtube.com/watch?v=AsQ_uJDBrIU

Science is easy and interesting. /Worksheet for children 1/

Science is easy and interesting. /Worksheet for children 2/





Science is easy and interesting. /Worksheet for children 3/

Lesson Plan Four: Toys are for everyone

Learning Objectives:
Children to acquire knowledge and skills for:

- Children learn through play, and toys are their tools through which they learn about the world around them.
- By playing, they interact with the environment, study it and enter the world of adults.
- The opportunity to get to know the world in which they live through toys combined with the pleasure that playing with them gives them helps them build self-confidence and absorb what is happening around them with wide open, curious eyes.

Learning outcomes:
Knowledge:

- acquisition of social skills through toys,
- what is gender tolerance in the public environment,
- what is a professional obligation expressed in a role play
- What is equality in the game

Skills

- children acquire performance skills,
- children acquire skills for sexual tolerance;
- children acquire skills for self-expression through toys;
- children acquire skills for tolerant attitudes, without sexual prejudices

Attitude:

- children work freely and use all means of communication,
- children self-assess freely.
-

Stereotypes &Counter Arguments – Girls only play with dolls
Counter Arguments – Girls show various interests, when set in an environment which fosters creativity, self expression and emotional freedom.
This topic is intended for:
- Toys enhance children's creativity and allow them to more easily express their emotions, develop their imagination and help them stand up and make individual decisions, regardless of gender
- Children put themselves in the place of the toy and act out various life situations that they have observed from adults or create their own completely imaginary world in which they are completely immersed.
- Support social development without gender discrimination
- Contribute to cognitive development

Guidelines for teachers

Description of the activities:
Discussion "The toys I play with"
The lesson starts with a video "Toys"
The teacher discusses why girls don't just play with dolls.
Building decision making skills / second exercise /
Breaking the stereotype through the possibility of exposing one's own position on the choice of toys for girls. / exercise three /
Building skills for working with hands / fourth exercise /.

Guidelines for piloting

The topic is useful for learning the ability to :

- creating conditions for fostering an attitude towards the social environment,
- development of the ability to work in a group;

- tolerance for the opinion of the children in the group;

protection of one's own opinion, through verbal argumentation

Recommended duration: 20 – 30 minutes

Assessment/ Evaluation:

We take into account the influence of gender in the self-expression of children and in their teamwork.

Materials, equipment:

Visual materials / on paper or electronic media /, Interactive whiteboard, multimedia, computer, cardboard, scissors, coloured pencils, coloured paper, wooden sticks, glue

Resources:

https://www.youtube.com/watch?v=RjRbX4UTOG8
https://zumipic.com/kak-da-si-napravim-avtobus-ot-kartonena-kutia-za-yaytsa/

Toys are for everyone. /Worksheet for children 1/

Toys are for everyone. /Worksheet for children 2/

How to craft a bus . /Worksheet for children 3/

Lesson Plan Five: Who can fly in Space

Learning Objectives:
Children to acquire knowledge and skills for:
- Occupations related to space,
- The essence of the space,
- characteristics of the types of work,
- the importance of work in human life.
the realization of self-determination / at the moment / in professional aspect / What do astronauts and people connected with the Cosmos do? /

Learning outcomes:
Knowledge:
- what is space – profession;
- what is gender tolerance;
- what is a professional duty related to spaceм
- what is professional equality.

Skills:
- children acquire performance skills,
- children acquire skills for sexual tolerance;
- children acquire skills for self-expression through space - professions;
- children acquire skills for tolerant relationships, without sexual prejudices

Attitude:
- children work freely and use all means of communication,
- children self-assess freely.

Stereotypes &Counter Arguments – Girls can't go to space
Counter Arguments – There are many women in astronautics, with brilliant accomplishments and career, who can be perfect role models and inspiration.
This topic is intended for:
- to help children understand the role of gender in the astronautics career,
- to build people's gender tolerance on / without gender restrictions/
- to break stereotypes related to male and female roles in space-related professions,

to develop the ability for self-determination /currently / in a professional aspect / What do astronauts and people connected with the Space do?/

Guidelines for teachers

Description of the activities:
Discussion "Who can fly in space?"
The teacher directs the children's attention to the space and the different types of space - professions and their professional characteristics.
Explains the possibility of practicing different professions without gender restrictions.
/ Discusses the video at the beginning of the lesson, emphasizing the desire of people to conquer the universe
The task is for the children to indicate for themselves whether a profession can be practiced by girls or boys. Requires answers to be accompanied by arguments. / second exercise /
The children are given the opportunity to choose a profession for a girl and a boy. / third exercise /
The children make a rocket out of paper.

Guidelines for piloting

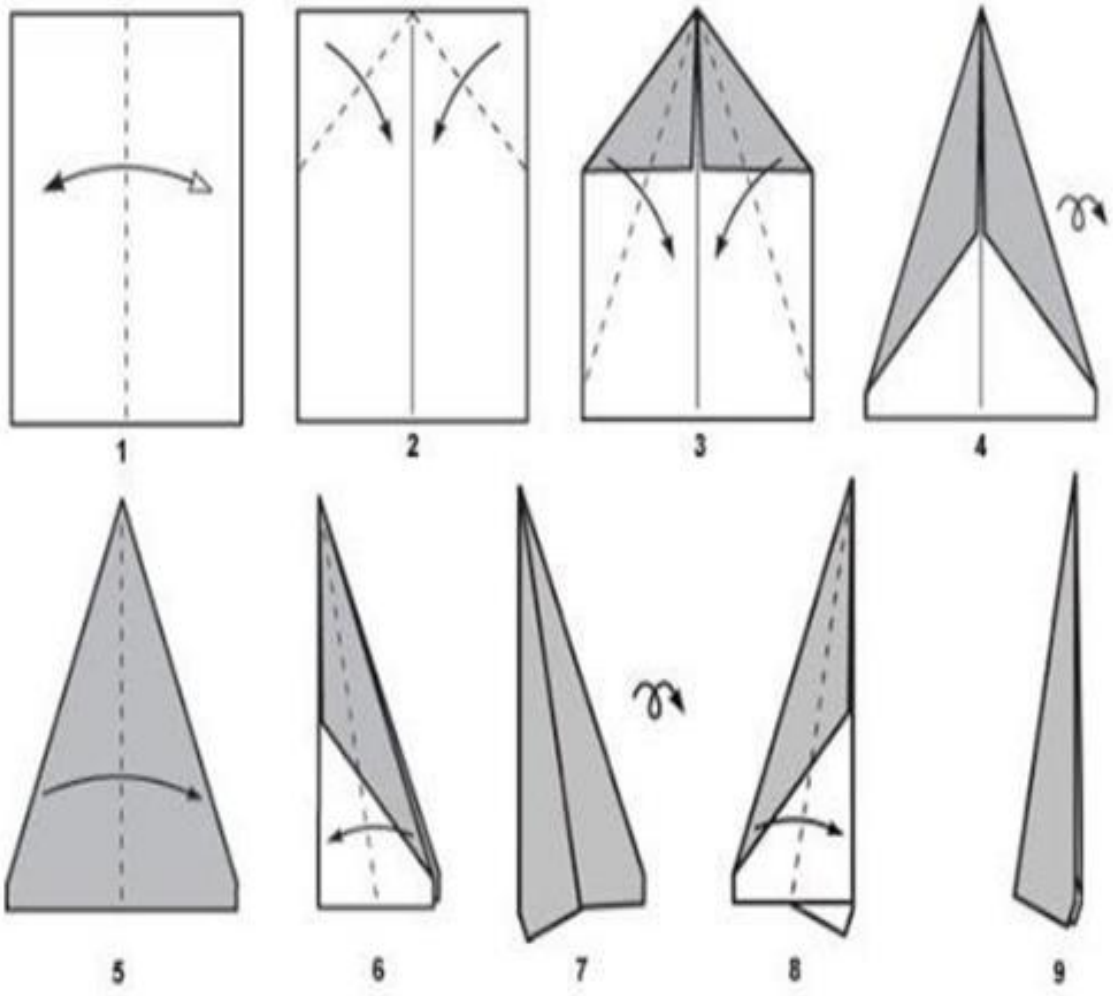
The topic is useful for learning the ability to:
- creating conditions for fostering respect and good attitude towards people from different professions related to space; development of the ability to work in a group;
- Tolerance to the opinion of the partner;

Defense of one's own opinion through verbal argumentation.
Recommended duration: 20 – 30 minutes
Assessment/ Evaluation: We take into account the influence of gender in the self-expression of children and in their teamwork.
Materials, equipment: Visual materials / on paper or electronic media /
Interactive whiteboard, multimedia, computer
Cardboard, scissors, coloured pencils
Resources: https://www.youtube.com/watch?v=mQrlgH97v94

Is space for girls?. /Worksheet for children 1/

Is space for girls?. /Worksheet for children 2/

Is space for girls?. /Worksheet for children 3/



Lesson Plan Six: Sport is for everyone

Learning Objectives:
Children to acquire knowledge and skills for:
- Gender-related sports,
- Nature of sport,
- characteristics of the sports,
- the importance of sports in human life.
the realization of self-determination / at the moment / in sports aspect
/ What do athletes and people related to sports do? /
Learning outcomes:
Knowledge:
- what is sport and the professions related to it;
- what is gender tolerance;
- what is a sporting obligation;
- what is sports equality.
Skills:
- children acquire performance skills,
- children acquire skills for sexual tolerance;
- children acquire skills for self-expression through sports;
- children acquire skills for tolerant relationships, without gender prejudices
Attitude:
- children work freely and use all means of communication,
- children self-assess freely.

Stereotypes & Counter Arguments – Boys are better and more interested in sports
Counter Arguments – Girls show the same passion and skills at sports, just like boys. Proof can be the overwhelming results of women in professional sports.
This topic is intended for:
- to help children understand the role of gender in sport-related realization;
- to build people's gender tolerance on / without gender restrictions/;
- to break stereotypes related to male and female roles in sport;
- to develop the ability for self-determination / currently /in sports aspect/.

Guidelines for teachers

Description of the activities:
Discussion "Which sport is for girls and which is for boys?"
The teacher draws the children's attention to the different sports and the different types of sports professions and their professional characteristics.
Explains the possibility of practicing different sports without gender restrictions.
/Discusses the video at the beginning of the lesson, emphasizing the desire of people to practice different sports/

The task is for the children to indicate for themselves whether a sport can be practiced by girls or boys. Requires answers to be accompanied by arguments. / second exercise/
The children are given the opportunity to choose a sport for a girl and a boy. / third exercise/
The children make paper boats. They compete with the boats in a vessel with water.

Guidelines for piloting

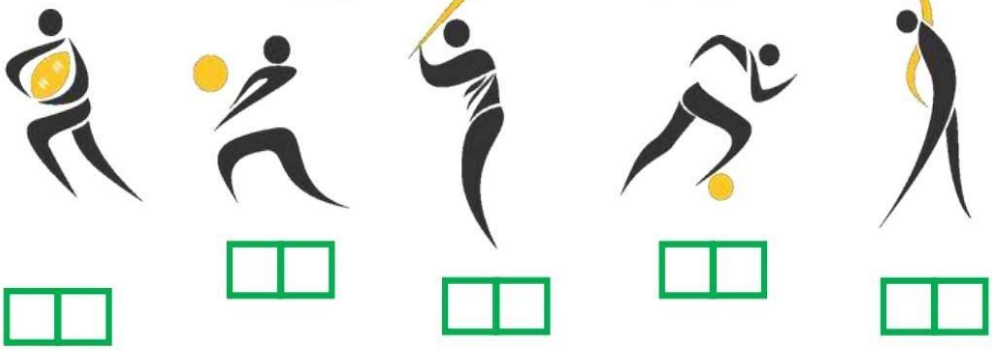
The topic is useful for learning the ability to:
- creating conditions for fostering respect and good attitude towards people practicing different sports;
- development of the ability to work in a group;
- Tolerance to the opinion of the partner;

- Defense of one's own opinion through verbal argumentation.

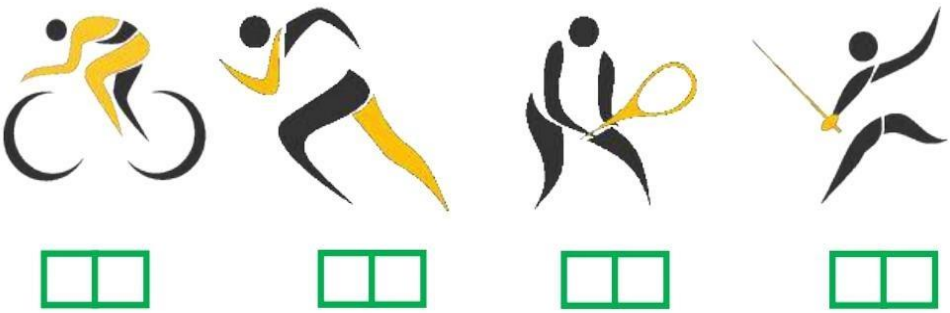
Recommended duration: 20 – 30 minutes
Assessment/ Evaluation:
We take into account the influence of gender in the self-expression of children and in their teamwork.
Materials, equipment: Visual materials / on paper or electronic media/, interactive whiteboard, multimedia, computer, cardboard, scissors, coloured pencils.
Resources:
https://www.youtube.com/watch?app=desktop&v=qkWlGmhBZVs&pli=1

SPORT FOR EVERYONE

Which sport is for boys and which is for girls?



SPORT FOR EVERYONE



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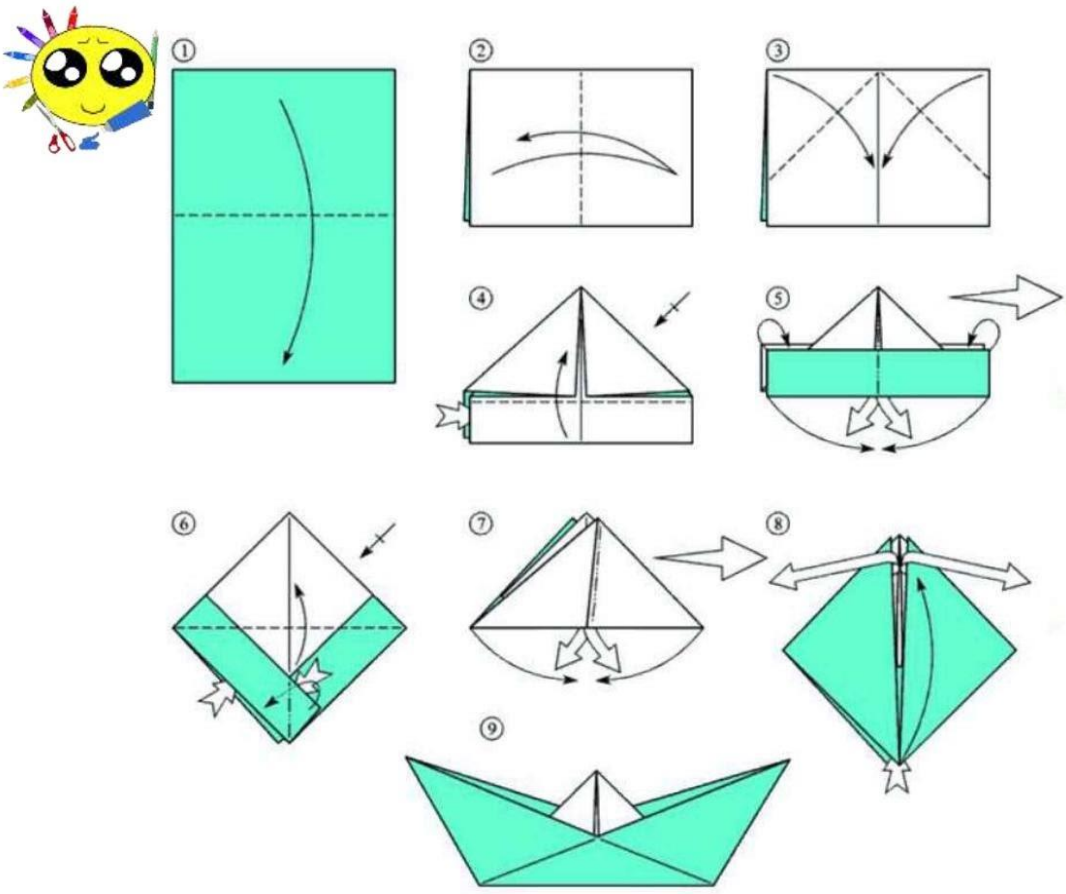
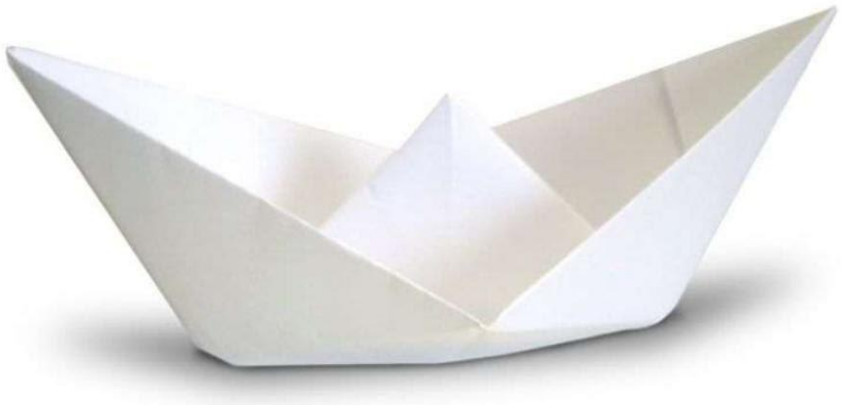
SPORT FOR EVERYONE





MODULE TWO: PRIMARY EDUCATION

Primary level will include pupils between the ages of 6 and 10, attending primary school. Our Romanian and Spanish partner developed lesson plans specific to this level based on their experience and partnership with local schools. Teachers interested in this level will be able to use these resources in their class in order to raise awareness among their pupils of equality of opportunities for all children from an early age.

Partner's description

Casa Corpului Didactic Mures is the Teaching Staff Training and Resource Centre of the Mures county. Casa Corpului Didactic Mures is an auxiliary unit of the Ministry of Education, with the following responsibilities:

- provide leadership and assistance in the development of the county and school-based policies, procedures, and criteria for the evaluation, selection, and challenge of learning resources;
- identify, in consultation with committees, priority curricular areas for schools
- provide staff professional development
- build a collection of bibliographic and evaluative sources to provide current information about learning resources and associated hardware;
- foster teacher involvement in the preview, evaluation, and selection of learning resources;
- guide the development and implementation of teaching staff training;
- maintain a cost-effective learning resource collection to supplement school collections;
- organize pilots and evaluation of selected learning resources;
- organize displays of learning resources;
- provide in-service on the potential use of instructional technologies and learning resources.

The institution operates with 1 manager, 5 teachers (mentors), and 4 support staff. Four of the teachers are methodologists and they train other teachers in specialized fields like didactics and pedagogy. There is a large pool of teacher trainers who collaborate with our institution.

The mission of CCD Mures is to promote innovation and reform in education, to provide the framework for the institutional development of the pre-university education units, for the personal and professional development of the staff employed in correlation with the occupational and continuous training standards, with the standards of education. quality and with the system of professional and transversal competencies necessary for the evolution in the teaching career, as well as in accordance with national and European policies and strategies in the field of education.

The Teaching Staff Training and Resource Centre designs and develops teaching and learning materials that are tropicalized and readily available, providing solutions for learning problems. The teaching staff is able to enroll and attend the courses, at the end of which they receive the allocated credits which are needed for their assessment by the school board or by the Mures Inspectorate Board for promotion or salary raising.

CCD promotes and facilitates the implementation of the effective use of learning resources.

Lesson Plan One: Aviators

Learning objectives: - by the end of the lesson a connections should be estabilished between arts and science lesson

- to raise awareness of teacher about their gender conscious and unconscious biases in primary school educational activities
- to counter gender stereotypes in STEAM education and give girls more interest in STEAM orientation (flying, working as pilots etc)

Learning outcomes: by concluding this session participants will have:

Knowledge: to compare and contrast teachers' behaviour concerning gender bias in STEAM class

Skills: - to identify skills which will engage more girls in STEAM

- to develop technical skills and abilities in making paper planes

Attitudes: to demonstrate a change in approach gender bias in STEAM class

Activities: **1st session**

1) Lead in: pictures with 4 different means of transportation (plane, train, ship, bus) T: 5'
2) Group-work: How much do we know about our means of transportation? T: 15'

This means of transportation should be driven by... T: 15'

Planes should be piloted by... T: 10'

Inter-session workload 1hrs – research: How to make a paper plane?

2nd session

3) Flying – general informations, female aviators and pilots T: 20'
4) Feed-back/result of the lesson: a tangible end-product will be paper planes. T: 20'
5) Plane contest. Who is the best pilot? T: 10'

Stereotypes & Counter arguments: Stereotype IV. STE(A)M is not for girls.

CA1: Since the introduction of ART in STEM many opportunities open for girls.

CA2: There is a new (somehow imposed)attitude towards girls and women in STEAM career paths

Guidelines for teachers

Description of the activities:

1) Lead in: - participants/pupils are invidet to choose from the four pictures of means of transportantion the one they consider most representative for each of them. Each pupil will give a short explanation for his/her selection. They will be grouped according to their selection in four groupes.
2) Pupils are divided in four groups, each group receives a flipchart paper, felt pens, markers etc. Each group has to write on the flipchart paper as many specific words/knowledge about that means of transportation as possible, then they will present that list to everyone. In the meantime the teacher will observe who were more active within a group: the boys or the girls.

3) Short discussion:
   a. which means of transportation should be driven by men or women. The pupils will stick the chosen images in these two categories. – debate on the selections
   b. Debate: why or why not – male or female drivers/pilots/captains

   General presentation of famous female aviators:
   a. https://www.treehugger.com/famous-female-aviators-4869244
   b. https://www.aerotime.aero/22935-female-pilots-breaking-stereotypes

   c. Do you know that romanian women are famous in piloting?
   https://ro.wikipedia.org/wiki/Elena_Caragiani-Stoienescu
   https://ro.wikipedia.org/wiki/Ioana_Cantacuzino

4) Handmade paper plane – each group will make a paper plane. Final flying contest: who is the best pilot/aviator

Guidelines for piloting

The topic is useful for widening perspectives on futute professions for girls, because aviation is a profession that is mostly adressed for boys.

Recommended duration: 80-90 minutes in two sessions

Assessment/Evaluation:

Constant observation on how gender influences self-expression, teamwork activities, self-development.

Materials, equipment:
Coloured cardboard, scissors, coloured pencils, flipchart, magnetic board.
Internet, PC, Tv

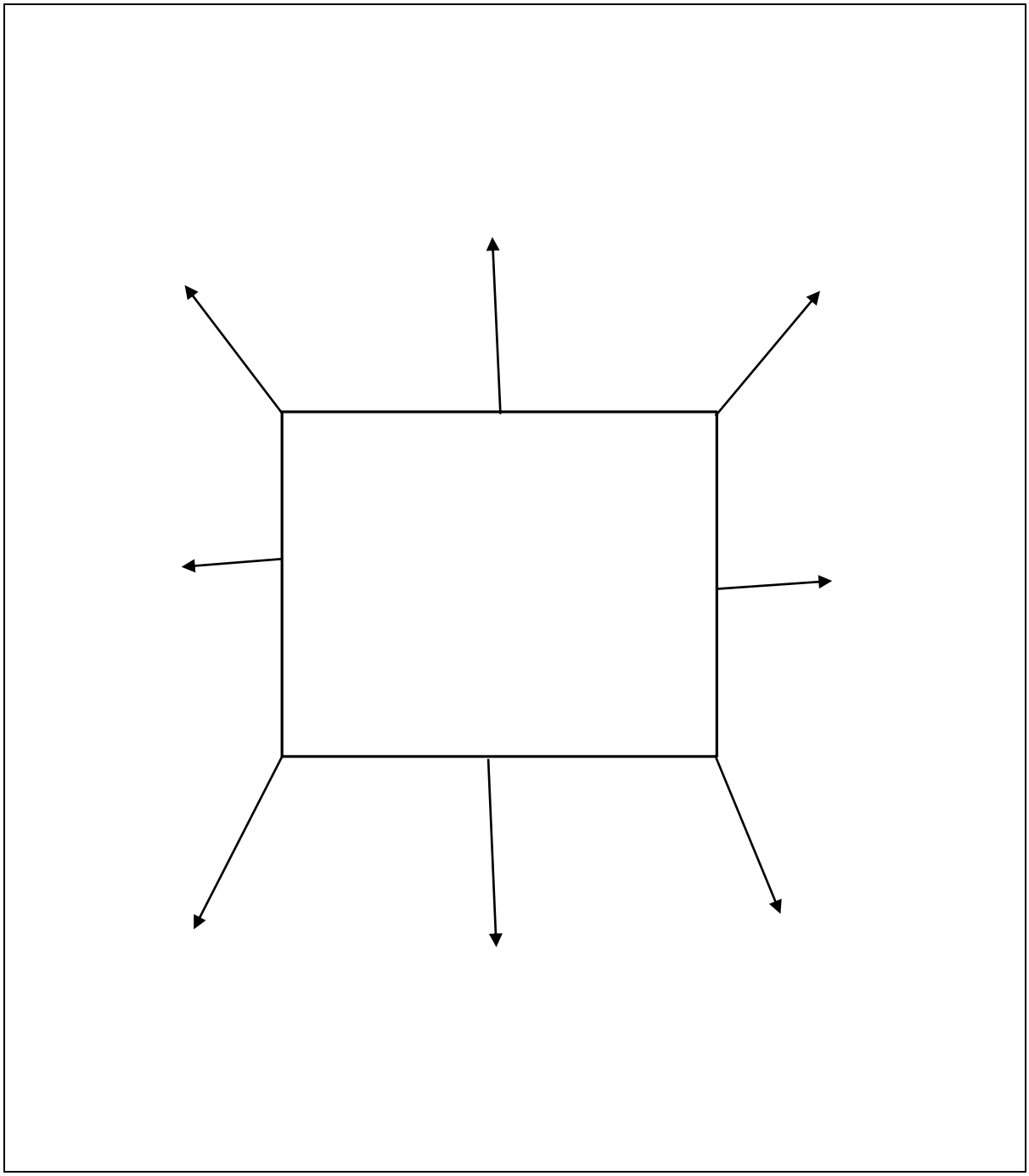
Resources:
https://www.treehugger.com/famous-female-aviators-4869244
https://www.aerotime.aero/22935-female-pilots-breaking-stereotypes
https://ro.wikipedia.org/wiki/Elena_Caragiani-Stoienescu
https://ro.wikipedia.org/wiki/Ioana_Cantacuzino

Handout nr. 1

Means of transportation

Handout nr. 2

How much do we know about our means of transportation?



Handout nr. 3

This means of transportation should be driven by:

Men/boys	Women/girls

Handout nr. 4

Planes should be piloted by:

Men/boys	Women/girls

Lesson Plan Two: Frederick, the mouse

Learning Objectives: - to know ways of verbal, nonverbal and paraverbal communication illustrated in literary texts.

- to practice artistic skills and abilities discovered in the story, to discover the beauties/advantages of different occupations

Learning outcomes: by concluding these session participants will have:

Knowledge:

- to compare and contrast teachers' behavior concerning gender bias in STEAM class
- what the professional duties are (workers – artists)
- what professional equality is

Skills:

- to identify skills which will engage more girls in STEAM
- artistic self-expression skills

Attitudes:

- to demonstrate a change in approaching gender bias in STEAM class, deconstructing stereotipes regarding occupations

Activities: 1) Lead in: Reading the story :15' (see the Description of the Activity & Handout 1)

2) Constructivist Theory (Handout 2) T: 20'

3) Reflection grid : Handout 3 : 10'

4) Free Feedback T:10'

Stereotypes & Counter Argument: Stereotype I. Girls show an aptitude for art and humanities

CA 1. *Boys are given more opportunities to construct, build and fix things. (This is in the nature of toys they are encouraged to play with).*

CA2. *Many women work in engineering too. (There are still opportunities for girls to work in*

Guidelines for teachers

Description of the activities:

1) Lead In - pupils will read, in turn, one paragraph from the collected story, underline unknown words, and try to be careful to understand the main idea of the story. (Handout1)

2) Constructivist Theory(PBL): Debriefing questions -questions will be asked by the teacher to help pupils in describing the story and for a better understanding of it. Open discussions on roles in life (woekers – artists), description, main characteristics of hard-working persons and artists, who they simphatise with etc. (Handout2)

3) Free Feedback - a processing alternative can be applied by watching the animation, advised that the English version will be followed, this would not be an impediment, provided a good reception of the text: **https://www.youtube.com/watch?v=uLEtQI2xsJg**

Guidelines for piloting

This topic is perfect example for deconstructing classical stereoripes concerning work (could an artistic career be considered a good job or not, is Frederick's attitude a right/correct one, who should be more successful artist: boys or girls, etc.), increasing awareness of the importance of artistic education.

It creates conditions for fostering respect and good attitude towards people from different professions related to artistic career; it also develops the the ability to work in a group;
It increases the tolerant attitude to the opinion of the partner;
It improves verbal argumentation.

Recommended duration: 45-50 min

Assessment/ Evaluation: By expressing personal oppinions regarding the main topics (jobs, career, artists) the teacher can observ how gender influences the pupils' way of thinking about the given topics.

Materials, equipment: Internet connection, Flipchart paper, Markers, Handouts 1, 2, 3.

Resources:
https://www.youtube.com/watch?v=uLEtQI2xsJg

Handout 1

Text support:

The meadow where the cows grazed and the horses ran was bordered by an old stone wall. Inside that wall, a family of very naughty field mice had taken refuge from a shed of shed and barn. The farmers had moved elsewhere, the shed had been abandoned, and the barn was empty. Winter was approaching, and so the mice gathered corn, and nuts, and wheat, and straw. They all worked tirelessly, day and night. All of them - but not Frederick.
-Frederick, why don't you get to work? the mice asked.
-"But I work," he said. I gather sunshine for the cold and gloomy winter days.
And when they saw him standing and scrutinizing the meadow, the other mice asked him:
-"But what are you doing now, Frederick?"
"I'm collecting colours," he said shortly. Because winter is gray.
Another time, when Frederick seemed asleep, they questioned him, rebuking him:
-"Are you dreaming, Frederick?"
But he protested:
-No mention. I stock up on words. Because there are many winter days, and endless ones, and at some point we won't have anything to say to each other.

And, behold, the days of winter came, and when the first snow fell, the five field-mice took refuge in hiding among the stones of the wall.

At first the mice ate to their heart's content, telling stories of filthy foxes and foolish cats. They were a happy family.
But, little by little, they nibbled on almost all the nuts and all the fruit, the straw was already gone, and only a faint memory of the corn remained. It was cold among the stones in the wall, and no one wanted to talk anymore.
They remembered how Frederick spoke to them about the sun's rays and colours and words. And then they asked him:
-"What about your supplies, Frederick?"
-"Close your eyes," Frederick told them, climbing a rock. Now I'm sending the sun's rays to you. Feel how their golden glow surrounds you ...
And as Frederick told them about the sun, the four mice felt them slowly warm up.
-Was it Fredrick's voice? Was it a spell?
- What about the colours, Frederick? The mice asked anxiously.
-"Close your eyes again ..." Frederick urged.
And as he told them about the blue sheep, the red poppies in the yellow wheat field, and the green blackberry leaves, they could see the colours, as if they had been painted in their minds.
-"What about the words, Frederick?"
Frederick cleared his throat, paused for a moment, and then, as if on a stage, began:
-"Who's smashing the snow? Who's melting it?"
- Who spoils the weather? Who cheers her up?
-Who grows the clover again in the month of Cherry?
-Who diminishes the day and lights the moon again and again?
Four field mice sit in the sky with burrows
Four field mice ... like me and you ...

In the Spring, the mouse brings the rain in its path
Then Summer gives the flowers colour
Next comes the Autumn-then, with nuts and ripe grains
And last but not least, Winter brings ... frozen paws.
There are four seasons, and they all make sense!
With three- or five-can you imagine what it would have been like?
When Frederick finished reciting, they all applauded him, saying,
- Okay, Fredrick, but you're a poet!
Frederick blushed, bowed, and said shyly.
-Yes I knew.

Handout 2

Debriefing questions:

1. Who are the characters in the story?

2. What does everyone do?

3. What actions of mice caught your eye and why?

4. What role did Frederick play in the group?

5. Were you surprised at any time? Why?

6. How important is choosing a problem-solving strategy of any kind?

7. Why do you think Frederick acted differently from the other mice?

8. Have you ever acted like Frederick? When?

9. Has any part of the story affected you in any way, the way you approach similar situations? What would you say to colleagues who have not heard the story?

10. What did you learn from this experience?

11. What will you do differently as a result of this experience? Think of a situation in which you will do something else, according to the lessons learned.

Handout 3

Reflection grid:

A round-up discussion will be "unpacked" under three major headings starting with the question:

Does this role of artist suit the mouse? Was a mice more suitable to perform such actions?	
For us as a group	
For each pupil	
For us as a person	

Lesson Plan Three: The figure of the ego

Learning Objectives:

- to form active listening skills for different points of view;

- to develop skills to analyze the identified prejudices and stereotypes;

Learning outcomes: by concluding these session participants will have:

Knowledge:

- to form attitudes corresponding to the subject discussed in the lesson, moving to other school, selecting school/bench-mates, new friends

Skills:

- to identify skills which will engage more girls in STEAM

- improved skills for integration, facing new challenges

Attitudes:

- to demonstrate a change in approaching gender bias in STEAM class

- toleracce in accepting unknown/new schoolmates/classmates

Activities:

1) Lead in: Ice breaking exercise:15' (see the Description of the Activity & Handout 1)

2) Constructivist Theory (Handout 2) T: 20'

3) Reflection grid : Handout 3 : 10'

4) Free Feedback – Handout 4 - T:10'

Stereotypes & Counter Arguments: Stereotype III. Girls like pink, boys like blue. Girls like glitter, boys like mud.

CA1. Colours are neutral. Society attributes gender characteristics to colours.

CA2. Girls like mud too - girls can enjoy activities that are often associated with action

Guidelines for teachers

Description of the activities:

1) Lead In – ice breaking at the beginning of the activity and identifying the psychological profile of the group members - The figure of the ego. Each pupil receives a form which they fill in, display on the pinwall and are presented by each one. (Handout1)

2) Constructivist Theory(PBL): Students are asked to write for two minutes everything that comes to mind when they hear the words prejudice and stereotype. Two schemes in the form of bunches are made on the board, on which the best ideas are noted. (Handout2).

Subsequently, on a flipchart sheet divided in half (stereotypes / prejudices) will be written the answers that will be discussed by all participants.

3) Starting from the identified ideas, a role play is proposed to the pupils. They will imagine that they are attending a new school and a new class and are put in the situation of choosing a classmate (dressed in pink, blue) or sitting alone. (Handout 3)

The choice is made by tickets, centralized on each group. The choices made are argued and the reasons why some pupils avoid certain colleagues are determined.

4) Free Feedback - Discussions about colours are discussed with the identification of causes and ways to remedy them. In groups, pupils complete the handouts that are passed from one group to another. (Handout 4).

Guidelines for piloting

The topic is useful for learning the ability to:

- easily integrate in new class comunity

- develope the ability of knowing people, without prejuduces

- tolerant attitude toward differences

Recommended duration: 45-50 min

Assessment/ Evaluation:

Constant observation on how gender influences self-expression, teamwork activities, self-development

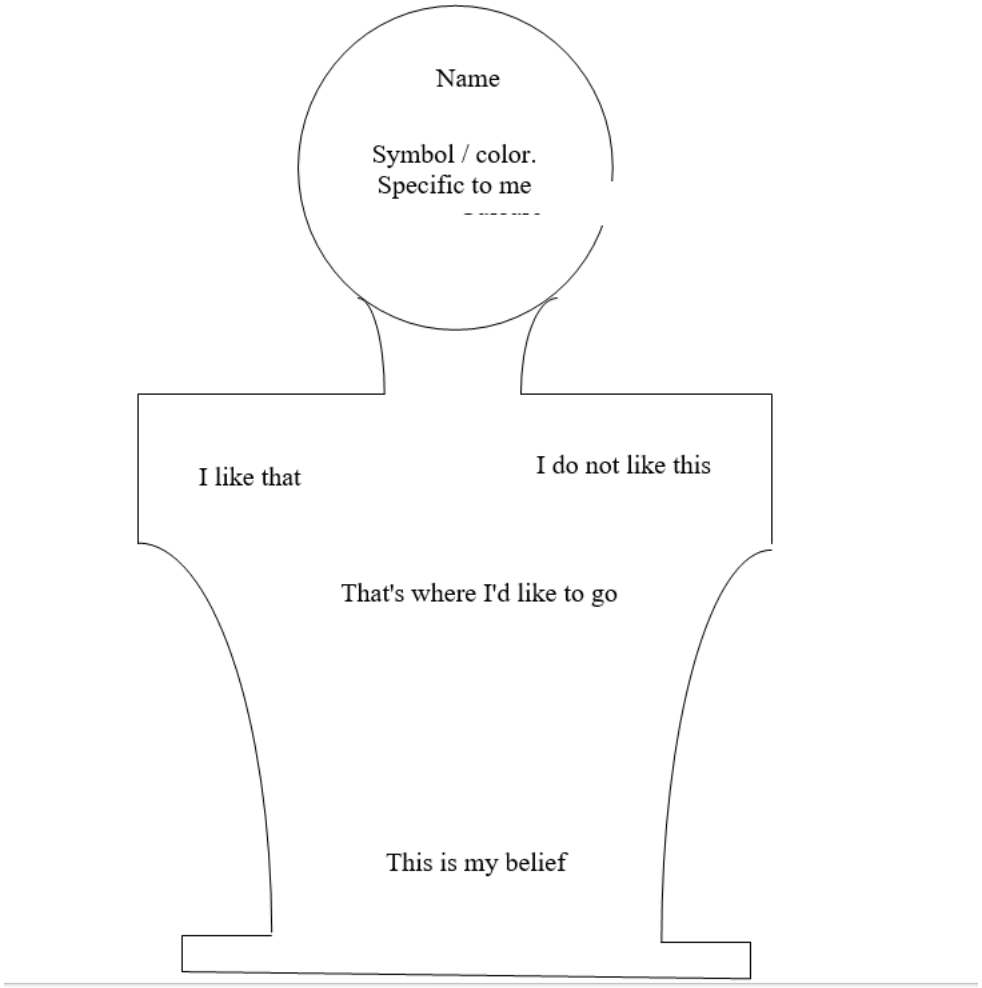
Materials, equipment: Internet connection, Flipchart paper, Markers, Handouts 1, 2, 3, 4

Handout 1

The figure of the ego

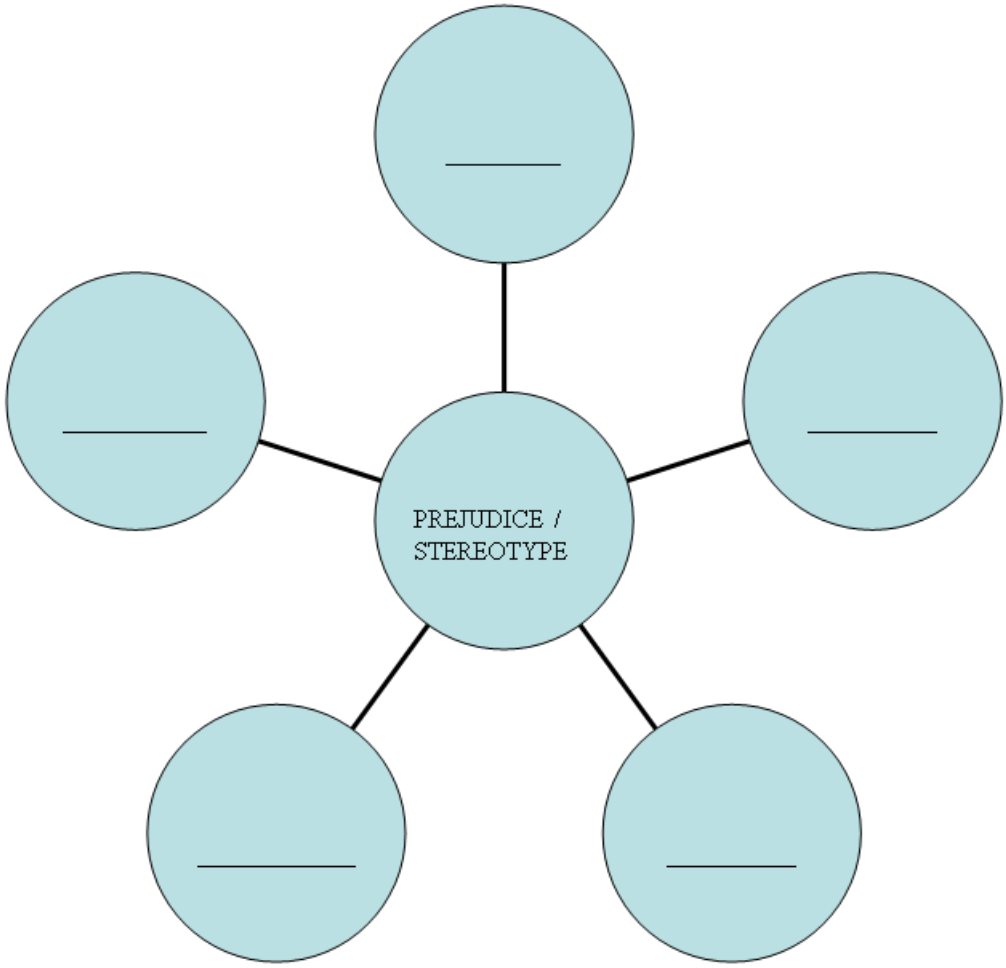
Objectives:

• Identifying the psychological profile of the group members, in order to solve the problems that appeared in the group, streamlining and anticipating the future functionality of the group;



Handout 2

Write for two minutes everything that comes to mind when you hear the words prejudice and stereotype



Handout 3

Imagine that you are attending a course and you are in the situation of choosing a bank colleague (dressed in pink or blue) or sitting alone. Argue!

Dressed in pink	Dressed in blue	Alone

Handout 4

Indicates biases regarding colours, identification of causes, and ways to remedy them.

COLOUR PREJUDICE	IDENTIFIED CAUSES	METHODS OF REMEDY

Partner's description

Postal 3 is an entity dedicated to the training, design and development of online resources, and project consulting, whose services to public and private organizations in Spain, Europe and America have achieved remarkable success and growth over the past two decades.

Postal 3 multipurpose work model integrates engineers, computer scientists, economists, financiers, designers, pedagogues, philologists, administrators, and an extensive catalog of teaching experts, in the most of the areas of knowledge linked to the improvement of work competences.

Postal 3 employs 48 permanent staff like technicians, managers, and support personnel in our regional offices, further trainers and teachers, until 300 wokers that collaborate with us each year. We form around 15.000 trainees in more than 400 courses per year. Postal 3 has five work or training centers in Spain: two in Vigo, and one in Pontevedra, Valladolid and Madrid, as also offices in Oporto, México, and Panamá.

Lesson Plan One: Thinking about gender "we are equal, we are different"	
Learning Objectives:	➲ to raise awareness of teachers of their gender conscious and unconscious biases in educational activities ➲ to counter gender stereotypes in STEAM education and give girls more interest in STEAM orientations ➲ to develop teachers skills concerning gender bias.
Learning outcomes:	By concluding this session participants will have: <u>Knowledge to:</u> ➲ Compare and contrast teachers behaviour concerning gender bias in STEAM class <u>Skills to:</u> ➲ Identify skills which will engage more girls in STEAM <u>Attitudes to:</u> ➲ Demonstrate a change in approaching gender bias in STEAM class
Activities :	1) Lead In: What are the differences? Time:25' (see the Description of the Activity & Handout 1) 2) Guidelines for teachers: Constructivist Theory (Handout 2) T: 30' (f2f or 1h online) 3) Inquiry-based learning(Handout 3) T:30'(f2f or 1h online) 4) Questionnaire for students 5) IBL put into practice: 60' f2f (Ts will play the role of ss) - 1st Session – 2h20' (when piloted) - Inter-session workload – 3hs (when piloted) - 2nd session – 1h40'(when piloted) 6) Reflection Grid T:15' 7) Free Feedback T:10'
Stereotypes & Counter Arguments	I. Girls show an aptitude for art and humanities. CA1. Girls have the potential to excel in STEAM subjects. CA2.There are many successful role models for girls in STEAM.

Description of the activities:

1) What are the differences?
For this activity we create mixed groups. We distribute the post-its, give them 10 minutes and ask them to write a clear difference between the two genders on each piece of paper. Each group will stick the largest number of post-its as they can on the Handout 1.

2) What are equalities?
For this activity we create mixed groups. We distribute the post-its, give them 10 minutes and ask them to write a characteristic common to both genders on each sheet of paper. Each group will stick as many post-its as they can on the Handout 1.

3) Who's the best?
For this activity we are going to debate which is better, being a boy or a girl. The groups can be mixed or by gender, they can also be interchanged. Each group has 1 minute to give a reason why they think it is better to be a boy, or a girl.

4) The qualities associated with gender
For this activity we create mixed groups. We distribute the post-its, give them 5 minutes and ask them to write a positive quality or virtue associated with the female gender on each sheet of paper. Then we give them another 5 minutes to do the same with the max-male gender. Each group will stick as many post-its as they can on the Handout 1.

5) Gender-associated defects
For this activity we create mixed groups. We distribute the post-its, give them 5 minutes and ask them to write a negative quality or defect associated with the female gender on each sheet of paper. Then we give them another 5 minutes to do the same with the max-male gender. Each group will stick as many post-its as they can on the Handout 1.

GUIDELINES FOR TEACHERS (online or face-to-face)

2)Constructivist Theory – Video film Q&A
https://www.youtube.com/watch?v=MBMawqyW2sc&t=50s
- Discuss the usability of the CT in STEAM
- Discuss the usability of the CT in STEAM

To look from a different perspective at our training and avoid the traditional class GE-STEAM's didactical approach for TP is using **the Constructivist Learning Theory** with everything which it consists of.
Here we have designed a YouTube video which explains in short this theory. Let's watch it:
https://www.youtube.com/watch?v=69jV1ggHdPw&rel=0 (3'.56")
Discussion: f2f/online
Time:15'
Q. **What are the characteristics of a constructivist class/training?**
A. (ideally)

- the learners are actively involved
- the environment is democratic

- the activities are interactive and student-centred
- the trainer facilitates a process of learning in which trainees are encouraged to be responsible and autonomous

Q. **Furthermore, in the constructivist learning, how do learners work primarily?**

A. In **groups** and learning and knowledge are **interactive and dynamic**.

Q. **How can you explain the focus on social and communication skills, as well as collaboration and exchange of ideas?**

A. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook.

Some activities encouraged in constructivist classrooms which you could noticed so far are: (these definitions are hanged around the classroom in big capital letters and they will read them in turn or are projected by a video projector on a screen)

- **Situated learning:** In contrast with most classroom learning activities that involve abstract knowledge which is and out of context,Lave argues that learning is situated; that is, as it normally occurs, learning is embedded within activity, context and culture. It is also usually unintentional rather than deliberate. Lave and Wenger call this a process of "legitimate peripheral participation"
- **Problem - based learning (PBL)** is a student centred pedagogy in which students learn about a subject through the experience of solving an open-ended problem found in trigger material Learners individually perform an experiment and then come together as a class to discuss the results.
- **Discovery learning/Explorative learning:** This allows learners put the concepts and ideas discussed in class in a real-world context by observing, discussing, trying out and reflecting on them. The self-developed experience strengthens self-confidence and arouses curiosity about further experiences.
- **Films and Inquiry learning** are about finding appropriate resolutions and thus questions and issues. Films provide visual context and thus bring another sense into the learning experience. Inquiry can be a complex undertaking and it therefore requires dedicated instructional design. Carefully designed inquiry learning environments can assist learners in the process of transforming information and data into useful knowledge. This technique is used in all of the methods described above. It is one of the most distinctions of Constructivist Teaching methods.

6) Inquire-Based Learning Guidelines

See the video:
https://www.youtube.com/watch?v=QlwkerwaV2E

Discuss the usability of the IBL in STEAM. Inquiry based learning is student centered. Lecturers become facilitators. Instead of lecturing to students, instructors develop questions and facilitate a student's ability to solve

those problems. As such, inquiry based learning shifts away from rote memorization of information as presented in books or lectures.

1. Interacting

The first phase of inquiry (often produced by strategies for promoting inquiry-based learning) is one characterized by interaction.

2. Clarifying

This happens by analyzing data, identifying and clarifying misconceptions, and otherwise 'getting a feel' for the scale, nature, and possibility of selected topics of inquiry.

3. Questioning

The questioning phase is a critical phase of the inquiry-based learning process, if for no other reason than misunderstandings, lack of organization, uneven confidence, or an inability to see the 'big picture' surface here more clearly than other phases.

4. Designing

At this final stage of the inquiry-based learning process, learners are focused on design.

GUIDELINES FOR TEACHER'S PILOTING ON STUDENTS
Student Impact Assessment Questionnaire

(see Handout IBL applied in the class)

1st Session

Students are divided into mixed groups as many are necessary. They receive post-its, felt pens, markers etc. The teacher explains the objective of answering the questions making it clear that there are no correct answers. Each group develops as many responses as possible within the agreed time frame.

The members of the groups which consist of both girls and boys dive into engaging, relevant, and credible approaches to identify an Idea and explain it.

2nd Session

They will extend the research process with other school students, networks, parents, friends online. The more opinions and points of view they get together, the better.

The time for this IBL will last for two weeks and will be monitored by the teacher who will play the role of a facilitator. It will involve work at home and recruiting volunteers and campaigning.

The results and the proposed projects will be presented as an "event" where school mates, head-teachers, decision-makers, mass media and parents will participate.

Each team will present their conclusions, its development and the results, in a way which they will consider most successful as presentation will be assessed as well.

5. Reflection Grid: It is a process of systematic review. Time is allowed at the end of every session for participants to think over the activities they have just experienced and make notes under various headings: For us as a group/For us as teachers/For our work with students.

6. Free Feedback: Teachers will like to know how information on the content, process and atmosphere as well as how and what students feel

	they are learning. Five minutes before the end of the lesson students are given a small 10x10cm piece of paper on which they (teachers and later students) are asked to give their feedback on the lesson. This kind of feedback will be used with the participants as well. At the end of each session they will receive such pieces of paper on which to write their feedback. The slips will be redistributed at the beginning of the next session, asking participants to ensure that they do not receive their own and then in a seated circle they are invited to read out the slip they have. Others with slips containing a similar theme or comment will read theirs. It serves as a link, reminding the group what happened during the last session.
Recommended duration:	➲ This activity is f2f and online. Together will last for about 7hs ➲ It will be distributed in two weeks 'time.
Assessment / Evaluation:	➲ Self-evaluation ➲ Ss evaluation
Materials, equipment:	Internet connection/BYOD Flip chart paper Post its Markers Handouts 1, 2, 3
Resources:	https://www.teachthought.com/pedagogy/4-phases-inquiry-based-learning-guide-teachers/ Author's own experience.

Handout 1P What are the differences? Stick it for the other trainees to see.

What are the differences?						
Number	**Who's the best?**		**Gender-associated defects**		**The qualities associated with gender**	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

Lesson Plan Two: Solving gender problems "boys and girls work together"	
Learning Objectives:	➢ to raise awareness of teachers of their gender conscious and unconscious biases in educational activities ➢ to counter gender stereotypes in STEAM education and give girls more interest in STEAM orientations ➢ to develop teachers skills concerning gender bias.
Learning outcomes:	By concluding this session participants will have: **Knowledge** ➢ to compare and contrast teachers ' behaviour concerning gender bias in STEAM class. **Skills** ➢ to identify skills which will engage more girls in STEAM **Attitudes** ➢ to_demonstrate a change in approaching STEAM classes
Activities :	**Time f2f: 2h40'** 1. Solving a problem of who is in charge - Guidelines for teachers: online 2. Solving a problem of who has to do what - (f2f) 3. Solving a communication problem – (f2f) 4. Solving an emotional problem 5. solving a strength problem **:** 6. Reflection Grid T:15' f2f 7. Free Feedback T:10' f2f
Stereotypes & Counter Arguments	II. Boys show an aptitude for how things work – linked to engineering work. CA 1. Boys are given more opportunities to construct, build and fix things. (This is in the nature of toys they are encouraged to play with). CA2. Many women work in engineering too. (There are still opportunities for girls to work in this sector).
Description of the activities:	Boys and girls work together Solving a problem of who is in charge For this activity we create mixed groups. They have to find the way to decide who is in charge and they have to explain why this is the best way to select a leader. They have ten minutes to define a protocol of five steps to do so. Solving a problem of who has to do what For this activity we create mixed groups. They have to solve the problem of the distribution of tasks between girls and boys and they have to explain why this is the right way to do it. They can use the post-its to define a five-step protocol and paste them in the wall. Solving a communication problem

	We have a communication problem in the group. There are two people that do not understand each other and the group has to work to help them. For this activity we are going to debate what the best solution is. The groups can be mixed or by gender, they can also be interchanged. Each group has 1 minute to give a reason why they think it is better to be a boy, or a girl. Solving an emotional problem Now we have a different problem here, there is someone crying in the next room and the group have to send one of them to help. For this activity we create mixed groups. They have to solve the problem of selecting the best person to help and they have to explain why this is the best option. They can use the post-its to define a five-step protocol and paste them in the wall. Solving a strength problem Now we have a different problem here, there is something heavy to move in the next room and the groups have to send one of them to help. For this activity we create mixed groups. They have to solve the problem of selecting the best person to help and they have to explain why this is the best option. They can use the post-its to define a five-step protocol and paste them in the wall. **5) Reflection Grid**: T: 15' f2f It is a process of systematic review. Time is allowed at the end of every session for participants to think over the activities they have just experienced and make notes under various headings: For us as a group/For us as teachers/For our work with students. **6) Free Feedback**: T: 10' f2f Trainers/Teachers will like to know how information on the content, process and atmosphere as well as how and what trainees/students feel they are learning. Five minutes before the end of the lesson students are given a small 10x10cm piece of paper on which they (teachers and later students) are asked to give their feedback on the lesson. This kind of feedback will be used with the participants as well. At the end of each session they will receive such pieces of paper on which to write their feedback. The slips will be redistributed at the beginning of the next session, asking participants to ensure that they do not receive their own and then in a seated circle they are invited to read out the slip they have. Others with slips containing a similar theme or comment will read theirs. It serves as a link, reminding the group what happened during the last session.
Recommended duration:	This lesson is run **f2f and online**. Together will last for about 2hs (1h50')
Assessment/ Evaluation:	**Self-evaluation** - **KWL(H) Chart** (What we know, What we want to know, What we have learned, How we know it). T:15' **Handout 2P** **Ts evaluation** – Feedback Dialogue on Feedback slips
Materials, equipment:	Internet connection/BYOD Flip chart paper/Post its/ Markers/Handout 1
Resources:	Author's own experience.

Handout 2P KWL. Self-evaluation chart.

Self-Evaluation chart			
How we know it	What we know	What we want to know	What we have learned

Lesson Plan Three: Changing your mind-set "boys and girls project"

Learning Objectives:

- to raise awareness of teachers of their gender conscious and unconscious biases in educational activities
- to counter gender stereotypes in STEAM education and give girls more interest in STEAM orientations
- to develop teachers skills concerning gender bias

Learning outcomes:

By concluding this session participants will have:

Knowledge to:

- Compare and contrast teachers behaviour concerning gender bias in STEAM class

Skills to:

- Identify skills which will engage more girls in STEAM

Attitudes to:

- Demonstrate a change in approaching gender bias in STEAM class

Activities :

Boy and girls project (developing a project to change the mind-set)

1) Changing your mind-set Time:15'
   a. (see the Description of the Activity & Handout 1)
2) Guidelines for teachers:
   a. Constructivist Theory (Handout 3) T: 30' (f2f or 1h online)
3) Project Based Learning (Handout 4) T:30' (f2f or 1h online)
4) Creating the groups PBL put into practice: 60' f2f (Ts will play the role of ss)
   a. Choosing the leaders
   b. Starting the project
   c. fulfilling objectives
5) 1st Session – 2h20' (when piloted)
6) Inter-session workload – 3hs (when piloted)
7) 2nd session – 1h40' (when piloted)
8) Reflection Grid T:15'
9) Free Feedback T:10'

Stereotypes & Counter Arguments

IV *Steam is not for girls.*

IV.CA1: Since the introduction of ART in STEM many opportunities open for girls.

IV.CA2: There is a new (somehow imposed) attitude towards girls and women in STEAM career paths.

Description of the activities:

Creating the groups

We have to create groups for the project and we have to decide who is in each group. We want to create mixed groups and they have to come up with a way to make the selection between girls and boys and they have to explain why this is the correct way to do it. They can use the post-its to define a five-step protocol and stick them on the wall.

Changing your mind-set

When we have created mixed groups. We have to solve the problem of the distribution of tasks between girls and boys and they have to find the way to decide who is in charge and they have to explain why this is the best way to select a leader. They have ten minutes to define a protocol of five steps to do so.

Choosing the project Title

The leader of every group has to organize the work starting for the selection of a title for the project. How are going the group to find a title for the project? Are there two persons that have different options for this? For this activity we are going to debate what the best solution is. The groups have to explain all the decisions.

Starting the project

With the groups, the leaders and the titles of the projects we can start to work in the definition of the objectives. Therefore, every group has to organize the work starting for the selection of an objective linked with the stereotype. The groups have to follow the same methodology that they use in the previous phases and explain all the decisions.

Fulfilling objectives

With the objective set, the groups can start working within the goal time frame. It is time to define the next steps to take to achieve the objective. We must also set the time available to perform each of the associated tasks. We can also do this using the same methodology as in the previous tasks.

GUIDELINES FOR TEACHERS (online or face-to-face)

Constructivist Theory – Video film Q&A

https://www.youtube.com/watch?v=MBMawqyW2sc&t=50s
- Discuss the usability of the CT in STEAM
- Discuss the usability of the CT in STEAM

To look from a different perspective at our training and avoid the traditional class GE-STEAM's didactical approach for TP is using the Constructivist Learning Theory with everything which it consists of.
Here we have designed a YouTube video which explains this theory in short. Let's watch it:
https://www.youtube.com/watch?v=69jV1ggHdPw&rel=0 (3'.56")
Discussion: f2f/online
Time:15'
Q. What are the characteristics of a constructivist class/training?
A. (ideally)

- the learners are actively involved
- the environment is democratic
- the activities are interactive and student-centred
- the trainer facilitates a process of learning in which trainees are encouraged to be responsible and autonomous

Q. Furthermore, in the constructivist learning, how do learners work primarily?

A. In groups and learning and knowledge are interactive and dynamic.
Q. How can you explain the focus on social and communication skills, as well as collaboration and exchange of ideas?
A. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook.
Some activities encouraged in constructivist classrooms which you could noticed so far are: (these definitions are hanged around the classroom in big capital letters and they will read them in turn or are projected by a video projector on a screen)

- Situated learning: In contrast with most classroom learning activities that involve abstract knowledge which is out of context,Lave argues that learning is situated; that is, as it normally occurs, learning is embedded within activity, context and culture. It is also usually unintentional rather than deliberate. Lave and Wenger call this a process of "legitimate peripheral participation"
- Problem - based learning (PBL) is a student centred pedagogy in which students learn about a subject through the experience of solving an open-ended problem found in trigger material Learners individually perform an experiment and then come together as a class to discuss the results.
- Discovery learning/Explorative learning: This allows learners put the concepts and ideas discussed in class in a real-world context by observing, discussing, trying out and reflecting on them. The self-developed experience strengthens self-confidence and arouses curiosity about further experiences.
- Films and Inquiry learning are about finding appropriate resolutions and thus questions and issues. Films provide visual context and thus bring another sense into the learning experience. Inquiry can be a complex undertaking and it therefore requires dedicated instructional design. Carefully designed inquiry learning environments can assist learners in the process of transforming information and data into useful knowledge. This technique is used in all of the methods described above. It is one of the most distinctions of Constructivist Teaching methods.

Project Based Learning Guidelines
See the video:
https://youtu.be/LMCZvGesRz8
https://www.youtube.com/watch?v=LMCZvGesRz8&feature=youtu.be

Discuss the usability of the PBL in STEAM. Skills developed in girls due to this approach: 4Cs
Communication / Collaboration / Creativity / Critical thinking. Finding out about Ts experience in PBL(Questions and answers/good practice) It is important to use PBL approach in STEAM with STEM strategies. Talking about the steps to follow for a well planned PBL.
Conclusion: Examples of the steps for a well designed PBL:
https://www.youtube.com/watch?v=_3yAODXnAsg&t=13s

Time: 10' 48"

I. Involve your students from the beginning (Brainstorming)
II. Break down the intro well defined tasks (Inquiry Based Learning)
III. Plan well, set goals, define outcomes (encourage Ss to ask questions IBL)
IV. Divide your class into working groups with well defined tasks
V. Create a tangible artifact as an outcome
VI. Arrive at a conclusion
VII. Document and present to a public audience

Starting the PBL by brainstorming and mind mapping with real life experiences/ local societal causes. Following the mentioned steps teachers will try to simulate PBL.

GUIDELINES FOR TEACHER'S PILOTING ON STUDENTS
Student Impact Assessment Questionnaire

(see Handout PBL applied in the class)

1st Session

Students are divided into mixed groups as many as necessary. They receive a flipchart paper, felt pens, markers etc. Each group will choose a topic linked with the stereotype. They will set a goal for the project:

E.g.

- Identify skills – For boys and girls
- Change gender mindset
- Open minds for gender equality
- Boys = girls

The members of the groups which consist of both girls and boys will receive "tasks" (according to their skills and talents) which they will be happy to fulfill. They will follow the steps mentioned in the PBL Guidelines. The project result will be a Video which will be shown in class or in the school.

2nd Session

In the second session, each team will present their project, its development and the results, in the way they consider most successful, since the presentation will also be evaluated. After the teams' project presentations, the attendees will vote and all participating teams will have a positive evaluation of their project that will count in the final grade.

The time for this PBL will last for two weeks and will be monitored by the teacher who will play the role of a facilitator. It will involve work at home and recruiting volunteers and campaigning.

The results and the proposed projects may be presented as an "event" in which schoolmates, principals, decision makers, the media and parents will participate. An assigned Events Committee will write the invitations, deliver them, and prepare the ceremony. Certificates and "awards" will be prepared. A "jury" made up of teachers and students will evaluate the "projects" according to an "Evaluation Sheet" in which the Event Committee draws up clear descriptions.

5. Reflection Grid: It is a process of systematic review. Time is allowed at the end of every session for participants to think over the activities they

	have just experienced and make notes under various headings: For us as a group/For us as teachers/For our work with students. 6. Free Feedback: Teachers will like to know how information on the content, process and atmosphere as well as how and what students feel they are learning. Five minutes before the end of the lesson students are given a small 10x10cm piece of paper on which they (teachers and later students) are asked to give their feedback on the lesson. This kind of feedback will be used with the participants as well. At the end of each session they will receive such pieces of paper on which to write their feedback. The slips will be redistributed at the beginning of the next session, asking participants to ensure that they do not receive their own and then in a seated circle they are invited to read out the slip they have. Others with slips containing a similar theme or comment will read theirs. It serves as a link, reminding the group what happened during the last session.
Recommended duration:	➲ This activity is f2f and online. Together will last for about 7hs ➲ It will be distributed in two weeks 'time.
Assessment/ Evaluation:	➲ Self-evaluation ➲ Ss evaluation
Materials, equipment:	Internet connection/BYOD Flip chart paper Post its Markers Handouts 1, 2, 3, 4
Resources:	https://en.danilodolci.org/news/project-based-learning-non-formal-youth-education/ Author's own experience.

MODULE THREE: Lower Secondary Education

Lower-secondary level will include pupils between thw ages of 10-12 in secondary school. Our Irish and Romanian partners developed lesson plans specific to this level based on their experience and partnership with local schools. Teachers interested in this level will be able to use these resources in their class in order to raise awareness among their pupils of equality of opportunities for all children from an early age.

This STEAM ***education*** *is fundamental to the development of a child and can significantly shape the later years of an individual's life.*

Partner's description

Future In Perspective Ltd. is a private company based in the border region of Ireland specialising in the areas of education and e-learning, media production, youth development and social inclusion.

Through our work on national and EU funded projects, we have engaged and supported local youth groups, migrant communities, older persons, and individuals who have been absent from education to re-engage with service providers and mainstream education and training offerings. We also have expertise in supporting businesses and entrepreneurs in niche markets such as the creative, cultural and green sectors to develop sustainable business models. In addition, we have collaborated with young people and adults to deliver a range of diverse programmes in the areas of media production and career management – supporting the next generation of creative individuals to build and sustain successful careers in the sector.

Lesson Plan One: Careers for Girls	
Objectives:	➲ To introduce female role models to students so that they can be inspired to recognise the role of women in the STEM sector. ➲ To engage students in identifying the qualities that women have that are suitable to careers in STEM. ➲ To mobilise students to address gender stereotypes in STEM through group activities and research. ➲ To support students to consider 'Careers for Girls' without gender stereotypes.

Learning outcomes:

Based on this lesson the participants will acquire:

Knowledge:

- Acquire basic knowledge of successful female role models in this sector.
- Acquire basic knowledge of the qualities that make a good role model.
- Acquire basic knowledge of how to promote STEAM careers for girls and women.

Skills:

- Research female role models in the STEM sector.
- Assess which qualities are most important to them in a role model.
- Engage in group-work activities to build their own role model.
- Collaborate with peers to develop a campaign for girls in their school, and further afield.

Attitudes:

- Awareness of the many female role models that exist in the STEM sector.
- Awareness of how to motivate girls and women into careers in STEAM.

Stereotypes and Counter arguments

Stereotype IV. STE(A)M is not for girls.

CA1: Since the introduction of ART in STEM many opportunities open for girls.

CA2: There is a new (somehow imposed) attitude towards girls and women in STEAM career paths.

Description of the activities proposed:

Lead in: Students will take part in a quick warm-up activity which will introduce them to some female role models in their everyday lives, that are not necessarily linked to STEM sectors. The aim of this short game is to introduce the topic of female role models to the class, without expecting them to know specific examples from the STEM sectors.

The teacher will then show each of the following videos, aiming to showcase some female role models for girls in the STEM sector.

- Extraordinary Women: Ada Lovelace - Inspiring story of first programmer - Educational Game for Kids - https://youtu.be/jl-vzdtEaVQ
- The genius of Marie Curie - Shohini Ghose - https://youtu.be/w6JFRi0Qm_s
- Rosalind Franklin: DNA's unsung hero - Cláudio L. Guerra - https://youtu.be/BIP0lYrdirI
- NASA Trailblazer: Katherine Johnson | National Geographic - https://youtu.be/E4j_LpKzcZQ
- Sylvia Earle - Exploring the Ocean for Sixty Years | Best Job Ever - https://youtu.be/KM-bEVFw8fQ

After each video, the teacher will host a short 5-minute feedback session with all students to ask:

- Did you ever hear of this role model before?
- What did you find most interesting about her story?

Once students have watched all of the videos, and engaged in the group discussion, students are then divided into smaller groups of 2 or 3, depending on the class-size, and are asked to 'Build their Own' Female Role Model for a STEAM Career. Girls and boys should participate in this activity. The aim of this activity is for teams of students to discuss the female role models that they have just been introduced to, to say what they found most inspiring about them, to list the qualities and attributes they have, and to decipher which of these attributes and qualities would contribute to their ideal role model. Students will be asked to repeat this activity as part of a home-work assignment, but for this classroom-based activity, they are being asked to complete this activity in pairs or small teams so that they can engage in a discussion and debate with their peers to decide which are the most important qualities for a role model to have.

As a follow-up activity, the teacher can ask students to select one of the female role models that they have been presented with through the videos, to complete further research on this woman and to plot the career pathway that she took, including any barriers and obstacles that she had to overcome.

In the second session, the teacher begins the session by playing the short video, 'Like a Girl'.

The teacher then splits the student group into smaller groups of 3-4 students this time. Together, they will brainstorm a campaign 'Like a Girl' Career Campaign. The aim of this campaign will be to promote careers in STEM among girls, and to make arguments for why girls are best suited to these careers. To complete this campaign poster, the teacher will give each group a copy of Handout 3.

After 60 minutes, the teacher asks all groups to take turns presenting their campaigns. After each presentation, other group members can share what they like most about each campaign, and what they find motivational about the campaign.

Materials, equipment:

- WiFi, Smart Phones/ Internet/ Videos/Websites
- Handouts included below

Recommended duration:

- Lead-In: Who Am I? – 10 minutes
- Video Showcase: Female Role Models in STEM – 50 minutes
- Group Work: Building my Own Role Model - 30

- Inter-session workload 2 hour to Select ONE Female Role Model from the videos presented, or from another STEM sector, and research her life, her career path, obstacles she overcame, etc.
- Watch this short 'Like a Girl' video - https://youtu.be/XjJQBjWYDTs - 3 minutes
- Group Activity - 'Like a Girl' Career Campaign – 60 minutes
- Presentation of Career Campaigns "For Girls" – 25 minutes
- Debriefing

Assessment/ Evaluation:

- *What have you learned about women in STEAM careers?*
- *What have you learned about the qualities you look for in a role model? Do you know any real-life examples of women who have these qualities?*
- *How do you feel about how careers can be marketed for women?*
- *What is the one thing that you have learned from this lesson that you will take with you?*
- *Has this lesson helped to influence how you think about STEAM careers?*

References and other useful sources:

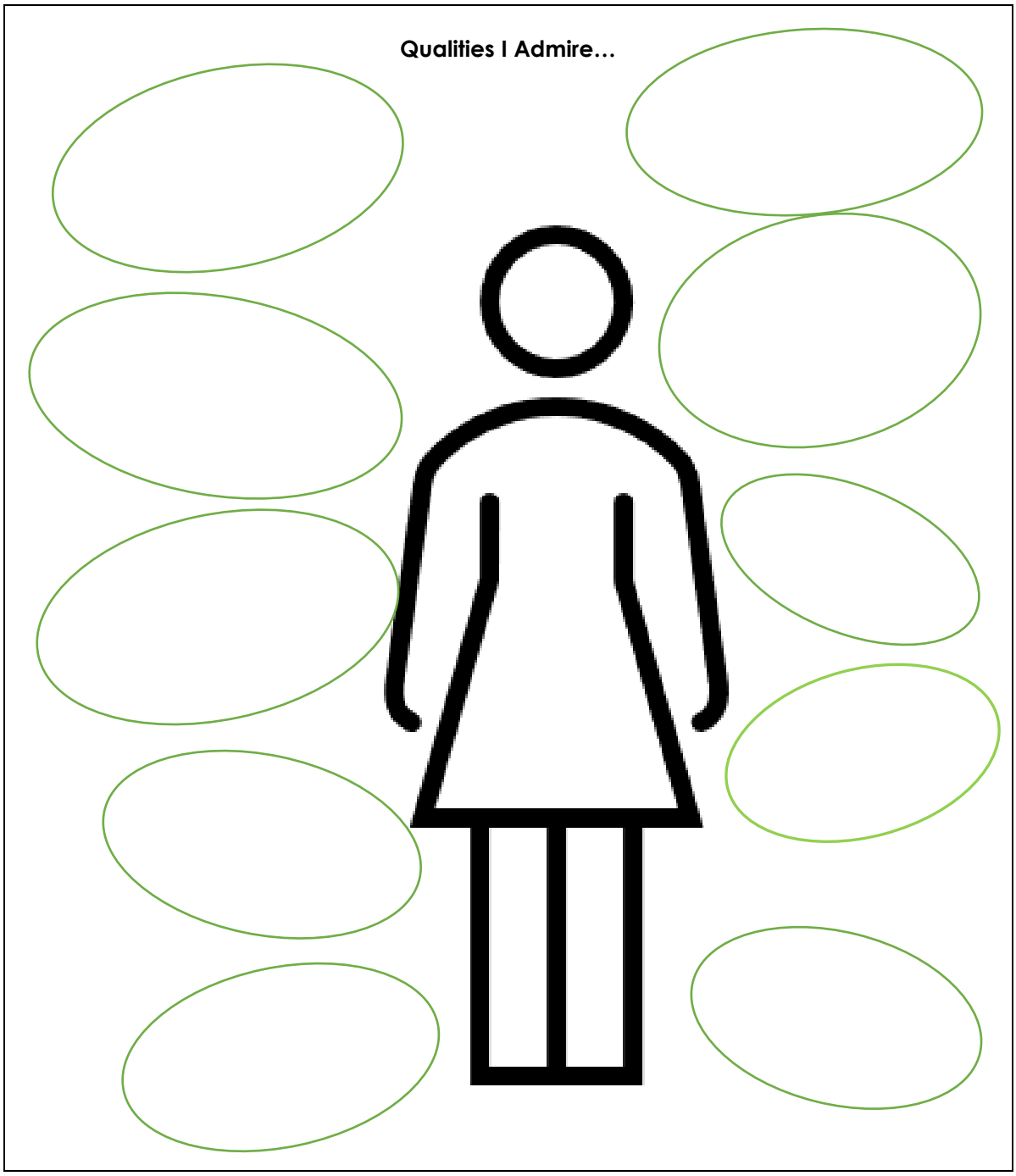
Handouts:

Lead-in Activity Description

Aim of Activity:
• The aim of this activity is to encourage students to think of female role models in their every-day lives, and to recognise the role that women play in many sectors. This is a warm-up activity, before female role models in STEM and STEAM are introduced to students in the follow-up activity.

Description of Activity:
• To begin this activity, the teacher will divide the group of students into smaller groups of 2 or 3, depending on the class size.
• The teacher asks all students to think of a female role model in their lives. They need to be someone famous, and someone that students look up to. The students are not to share the name of their role model with anyone.
• Taking it in turns, students in each small group will ask a series of questions to their peers to try and guess who their female role model is. These can only be questions where the answer is either 'yes' or 'no'. When the student answers 'yes' the other students in their group can ask another question, until they get a 'no' answer. When the student answers 'no', the student to the left can answer questions about their role model.
• This will be continued until the student can guess the role model of the other student, or until the time is up.
• After 10 minutes, the teacher can call an end to this warm-up activity.

Handout No.1 – 'Build Your Own' Female Role Model



Handout No. 2 – 'Like a Girl' Career Campaign

Title of Campaign	
Campaign Slogan	
Campaign Logo (Draw)	
Target Age for Campaign	
Careers Covered in Campaign	• . • . • . • . • .
5 Reasons why Girls are Made for these Careers:	• . • . • . • . • .
How will you Spread News about your Campaign?	

Lesson Plan Two: Gender and Colours

Objective:

- To introduce how gender stereotypes can impact our perceptions of colours, and the genders we associate with different colours.
- To introduce how our perception of different STEAM careers can be represented through colour.
- To imagine a world where colour and gender stereotypes were reversed.
- To debate the role of colour in re-enforcing gender stereotypes.

Learning outcomes:

Based on this lesson the participants will acquire:

Knowledge:

- Acquire basic knowledge of how gender stereotypes impact our perception of colour.
- Acquire basic knowledge of how colours are also used to further support gender stereotypes.
- Acquire basic knowledge of the arguments for and against the gendered use of colour in society.

Skills:

- Assess their own gender bias related to colours.
- Write a story where gender stereotypes are reversed.
- Collaborate with peers to engage in a debate about how colours impact our perception of gender, and vice versa.

Attitude:

- Awareness of how colours can reinforce gender stereotypes.
- Awareness of how career avenues are closed off to girls from a young age, due to gender stereotypes and the use of colours

Stereotypes and counter arguments

Stereotype III. Girls like pink, boys like blue. Girls like glitter, boys like mud.

CA1. Colours are neutral. Society attributes gender characteristics to colours.

CA2. Girls like mud too - girls can enjoy activities that are often associated with action.

Description of the activities proposed:

Lead in: Students are invited to participate in an ice-breaker activity, described below, which uses the medium of colour to discuss gender stereotypes related to STEM and also to colours.

Following on from this activity, students then engage in a group discussion with their teacher about whether they consider colours to be male, female, or neutral and why? It is thought that after the icebreaker, students may select colours like blue, grey or navy to represent some of the STEM sectors, as these are male-dominated sectors and are typically also seen as male colours. If this is the case, this can lead into a group discussion about 'male' and 'female' colours.

Once all students have engaged in this discussion, the teacher then divides the students into smaller groups of 2-3 students. In their groups, students will take a pen and paper and make 3 columns – for: male colour, female colour, neutral colour. The students will then look around the classroom and for every colour they can see, they need to decide between their group members whether they are 'male', 'female' or 'neutral' colours, and why. After 10 minutes, the teacher can bring the whole group back together to review the findings of this activity.

After this short group activity, the teacher will give each student a copy of Handout 2. In this handout, students will be asked to imagine a world where gender stereotypes are reversed, and where male colours are seen as female colours. The aim of this activity is to see how the students see the world through the lens of gender stereotypes. By asking students to talk about what the world would be like if gender stereotypes are reversed, we can gain an insight into the gender stereotypes that students are aware of – because this is what they are writing about. It is, therefore, important that this is an open writing activity, as we are trying to discover what students believe about gender stereotypes and gendered colours. By freely writing about this topic, the teacher will be able to discover what students believe about gender, colours, and their roles in society. This is an important first step in supporting students to form their own counterarguments and counter-narratives to fight against gender stereotypes. After 40 minutes, the teacher can ask students to share their short stories with the whole class.

As a follow-up activity, the teacher can ask students to research gender stereotypes and colours, especially related to advertising and how toys are made and marketed to different genders. For this, students are encouraged to watch this short video: https://youtu.be/nWu44AqF0iI - and to take notes about how colours have come to represent our genders.

In the second session, students will be given the opportunity to engage in a debate about gender stereotypes and colours. The topic of the debate is: 'Blue if for Boys; Pink is for Girls'. Students will work in teams of 4, and they will be given 30 minutes to prepare for this debate. They must prepare arguments for the motion, and against the motion. This is important so that they are aware of the arguments on both sides of the debate.

Depending on the class size, the aim is to have a minimum of 4 debate teams, each with 4 members. The debate will take 60 minutes in total. This will allow each team the following time:

- 15-minutes to debate for the motion.
- 15-minutes to debate against the motion.

Based on this schedule, each team member will have the opportunity to witness the debate on both sides (as they are members of the audience) and to argue for and against the motion. The idea with this debate is to engage students in critically evaluate how the colours have been

'gendered', and the impact that this can have on how children develop – by the toys they play with, the things they therefore think they are good at and ultimately the careers they follow. By challenging the gender stereotype in colours, students will also be engaged in debating how they can challenge the gender stereotype in education.

Materials, equipment:

- Handouts, pens and writing materials
- Breakout space for debate teams to practice
- M&Ms, Skittles or coloured sweets for the ice-breaker
- WiFi, smartphones, laptop, video projector/TV

Recommended duration:

- Lead-In: Colour Candy Ice-breaker – 10 minutes
- Group Discussion: Do you think colours are masculine, feminine, or neutral? – 10 minutes
- Small Group- Activity: List all the colours that you think are 'masculine', 'feminine' and 'neutral' – 20 minutes
- Writing Activity: The Story of Mr. Pink and Ms. Blue – 50 minutes
- Inter-session workload 1-hour to Research: Gender Stereotypes and Colours - As part of this independent study, students are asked to watch this short video: https://youtu.be/nWu44AqF0iI
- Debate Prep: Blue is for Boys; Pink is for Girls – 30 minutes
- Debate (4 Rounds): Blue is for Boys; Pink is for Girls – 60 minutes (4 x 15-minute rounds)

Assessment/ Evaluation:

- Debriefing (Q&A)

When you finish the activity, use the questions below to start a discussion in plenary:

- *What have you learned about the role of colour to reinforcing gender stereotypes?*
- *How effective was the debate activity in helping you to understand the role of colour?*
- *How can you challenge these stereotypes in your daily life, in school and in your future career?*
- *What is the one thing that you have learned from this lesson that you will take with you?*
- *Has this lesson helped to influence how you think about STEAM careers?*

References and other useful sources:

Handouts: Lead-In Activity Description

Aim of Activity:

This is a simple icebreaker that will get teachers and students sharing information about themselves and what they think of gender roles and influences in the STEAM sector. The reason why this activity was chosen is that this lesson plan focusses on colour, and what colours we associate with each gender. Therefore, we will start with a short icebreaker activity that will use colour to get people thinking about and talking about gender roles and norms in STEM.

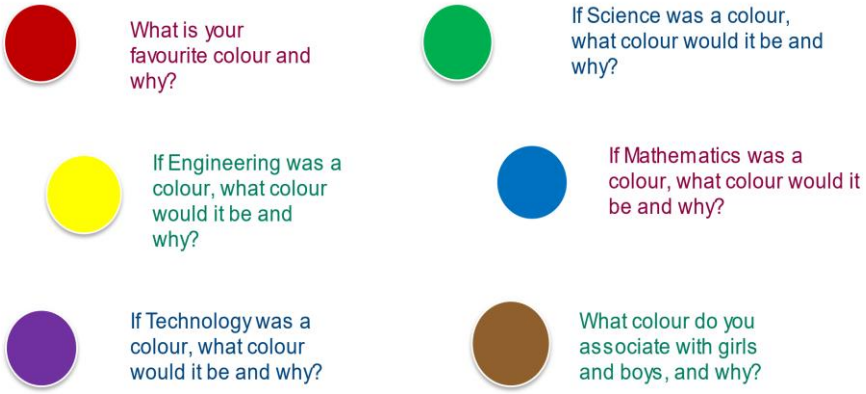
The aim of this activity is also to assess if students think of STEM careers as being 'male-dominated' through the colours they select to represent these different sectors. This will be achieved by asking students is more 'masculine' colours were chosen for each of the STEM sectors or not.

Description of Activity:

• To begin this activity, the teacher/facilitator will need a bowl of colourful sweets – M&Ms or Skittles are good sweets to use for this activity.

• The teacher/facilitator offers a sweet to each student. Each student selects a sweet at random.

• When all students have a sweet, the teacher/facilitator then shows the following slide:



• Based on the colour of the sweet in the students' hands, they must answer the question allocated to that colour.

• After all students have participated in this activity, the teacher/facilitator can lead a short verbal feedback session to ask:

O In selecting the colour for the STEM subjects, do you think people chose most 'male' or 'female' colours? And why?

O What did they learn about our perception of colours through this activity?

Handout No. 1 – The Story of Mr. Pink and Ms. Blue

Story of Mr. Pink	Story of Ms. Blue

Lesson Plan Three: Gender and the Actiotope Model of Giftedness

Objectives:

- To introduce the 'actiotope model' to teachers so that they can assess their own gender bias and gender stereotypes.
- To support teachers to create a gender-neutral teaching style that can motivate girls to assess their interests in STEAM subjects, without being restricted by gender stereotypes.

Learning outcomes:

Based on this lesson the participants will acquire:
Knowledge:

- Basic knowledge of how gender stereotypes impact our awareness of world of science.
- Basic knowledge of the 'actiotope model'.
- Factual knowledge of one's own gender stereotypes and bias

Skills:

- Assess their own gender bias and gender stereotypes they follow as teachers.
- Assess their own motivations for STEAM subjects.
- Apply what they have learned to motivate girls to overcome gender stereotypes in STEAM subjects.

Attitude:

- Awareness of how teaching style can be impacted by gender stereotypes.
- Awareness of how teaching style can influence what subjects and careers are most engaging for girls.

Stereotypes and counter arguments

Stereotype I. Girls show an aptitude for art and humanities.

CA1. Girls have the potential to excel in STEAM subjects.

Description of the activities proposed:

Lead in: Teachers and pupils can both complete this activity. The aim of this activity is to engage teachers and students in listing all inventions they can think of that were first developed by women, and also those inventions from male scientists and inventors. The objective is to assess the level of knowledge and awareness of teachers and students about female vs. male inventions, and to assess why that is.

Next, teachers will engage in a series of small group discussions. Working in groups of 2-3 teachers, the aim of these discussions is to engage teachers in unpacking the role that gender stereotypes can play in influencing their teaching style and practice. Through these shorter sessions, teachers will discuss:

- How do gender stereotypes impact how we view the world of science? – 15 minutes

- How does this impact our teaching practice? – 10 minutes

After each round of discussions, the facilitator will ask each group to feed-back any conclusions they have reached.
Next, teachers will collaborate to develop an activity sheet that they think will be motivating for girls in their classes. The template for this activity is presented in Handout 2. This sheet should be developed by teachers to address one or more of the STEAM subjects that they currently teach to girls. This activity should last approximately one teaching session of 40-45 minutes. As a follow-up activity to this lesson, teachers will be invited to deliver this activity to girls in their class and to assess its effectiveness in motivating the girls in that subject.

This will close the first session, after which teachers will be invited to engage in some individual research on the topic of 'The Actiotope Model of Giftedness'.

To start session 2, teachers will engage in a whole group discussion to highlight what they have learned through their individual research and what they found most interesting about this model. Each teacher will be given 2 minutes to share their findings with the group.

Following on from this discussion, teachers will be invited to complete the Actiotope Handout (Handout 3) based on their own understanding of their action repertoire and their subjective action space. The idea here is that teachers will first complete this activity as learners, and they will then transfer this activity to boys and girls in their classes, so that they can support girls to address any deficiencies in their 'subjective action space' related to STEAM subjects.
Once teachers have completed this Handout template, they will each be asked to present their completed Handout to all participants in the group, and to list the main finding – what they learned about themselves – through this activity.

After these presentations, all participants will engage in a group discussion and feed-back session. During the feedback, participants will be asked to state:

- What is the main take-away from today's session?
- What did I learn about how gender stereotypes impact teaching practice in general?
- What did I learn about my own gender stereotypes?

The facilitator will take a note of the main feedback on a flipchart. The facilitator will then thank all participants for their active participation and will close the session.

Materials, equipment:

- Handouts, pens and writing materials
- Breakout space for ice-breaker
- WiFi, smartphones, laptop, video projector/TV

Recommended duration:

- Lead-In: Female vs. Male Inventions – Quick-fire Round – 20 minutes
- Group-Discussion: How do gender stereotypes impact how we view the world of science? – 15 minutes
- Group-Discussion: How does this impact our teaching practice? – 10 minutes
- Group-work: Complete an Activity Sheet template that would motivate girls in STEAM subjects – 45 minutes
- Inter-session workload 2hour to Research: Actiotope Model of Giftedness
- The Actiotope Model of Giftedness – Sharing from Individual Research – 20 minutes
- Completing the Actiotope Wheel – Individual Activity – 30 minutes
- Presenting my Actiotope Wheel – Individual Presentations – 30 minutes
- Feedback and Close – 10 minutes
- Debriefing (Q&A)

Assessment/ Evaluation:

When you finish the activity, use the questions below to start a discussion in plenary:

- *What have you learned about your own gender bias and stereotypes in this lesson?*
- *What have you learned about how this could impact your learning and/or teaching?*
- *How do you view your own skills now that you have analysed your competences using the Actiotope Wheel?*
- *What is the one thing that you have learned from this lesson that you will take with you?*
- *Has this lesson helped to influence how you think about STEAM careers?*

References and other useful sources:

Handouts: Lead-In Activity Description

Aim of Activity:
The aim of this activity is that teachers will be asked to think of inventions by female scientists or inventors on the spot, without any chance to research their answers. They will be asked to list as many inventions as they know, and then they will be asked to repeat the activity with male inventions. The objective is to see how long both rounds of activities last, and to compare if teachers are more aware of inventions by men, than women.

Description of Activity:

• This activity will be hosted as a `quick-fire round' where teachers are placed standing in a semi-circle.
• The facilitator of the training will time this first session.
• The activity starts with the first teacher holding an imaginary ball in their hand.
• The teacher needs to name an invention by a female scientist or inventor, and then throw the imaginary ball to the next teacher, who then names an invention by a woman.
• This activity is repeated until the teachers run out of inventions by women.
• The facilitator of the session will take a note of all of the inventions mentioned by teachers for fact-checking after the activity.
• Once the teachers have listed all of the inventions by women, they will be asked to repeat this activity by listing the inventions developed by men.
• The facilitator will again time this session, will note down the inventions listed and will also end the session once teachers have listed all inventions that come to mind.
• At the end of this second round, the facilitator will show the teachers the difference between the time required for both rounds of this activity, and also the list of inventions generated by both sessions.

Follow-up Activity:
• Teachers are each given the list of inventions they mentioned that were developed by women, and they will be asked to fact-check each of these inventions.
• Teachers will also be asked to research and list the 10 most important inventions created by women, and to bring this list to the next session.
• Teachers will be invited to repeat this activity with students in their class, and to set the two afore-mentioned follow-up tasks to students in their classes as home-work activities.

Handout No. 2 – Activity Sheet for Motivating Girls in STEAM

Activity Title	
Duration of Activity (in minutes)	
Learning Outcomes	*State the learning outcomes that girls will achieve on completion of this activity.*
Aim of activity	*Describe here the value of completing this activity for female students - this section should motivate girls to complete the activity.*
Materials Required for Activity	*List here all of the materials and equipment required for girls to complete the activity.*
Step-by-step instructions	*Provide a list of steps that girls will have to complete to undertake this activity:* *Step 1 xxx* *Step 2 xxx*
Template	*Provide a handout or activity template that girls will need to complete this activity.*
Self-Reflection	*Include here some self-reflection questions for girls to answer to assess how this activity has impacted their motivation.*

Handout No. 3 – The Actiotope Model of Giftedness

"An individual's actiotope consists of four interacting components: environment, goals, action repertoire, and subjective action space. The environment represents the material and symbolic framework for an individual's goal-oriented actions. The action repertoire includes all actions an individual is theoretically capable of performing, and the action repertoire actually used by an individual is designated as his/her current action repertoire. A person's subjective action space contains all behaviour he/she perceives as feasible for himself/herself."

(Kollmayer, et all, 2020)

"Because the actions of a person change the environment, the actions needed to be considered as talented, gifted or showing excellence change with the progression of time. The main elements of the model are:

- *Actions consisting of a sequence of partial actions, each of them being a composition of parallel and multiple actions, which require regulation on several levels.*
- *The action repertoire understood as sustainable possibilities for action an individual is capable of executing.*
- *The subjective action space: What people believe they are able to do. (Girls for instance often underestimate their action repertoire.)*
- *The goals: What people want to do. Every person has several goals, the most important for the gifted are the development of excellence, and the employment of an excellent action repertoire.*
- *The environment is characterized by a rapid alteration of domains.*
- *And the interactions among the components resulting in a constant quest for equilibrium and progressive adaptation of the individual to the environment and therefore the ability to realize when an action was successful, to recognize when action will be successful, and to generate variations of actions."*

(Ziegler, 2007)

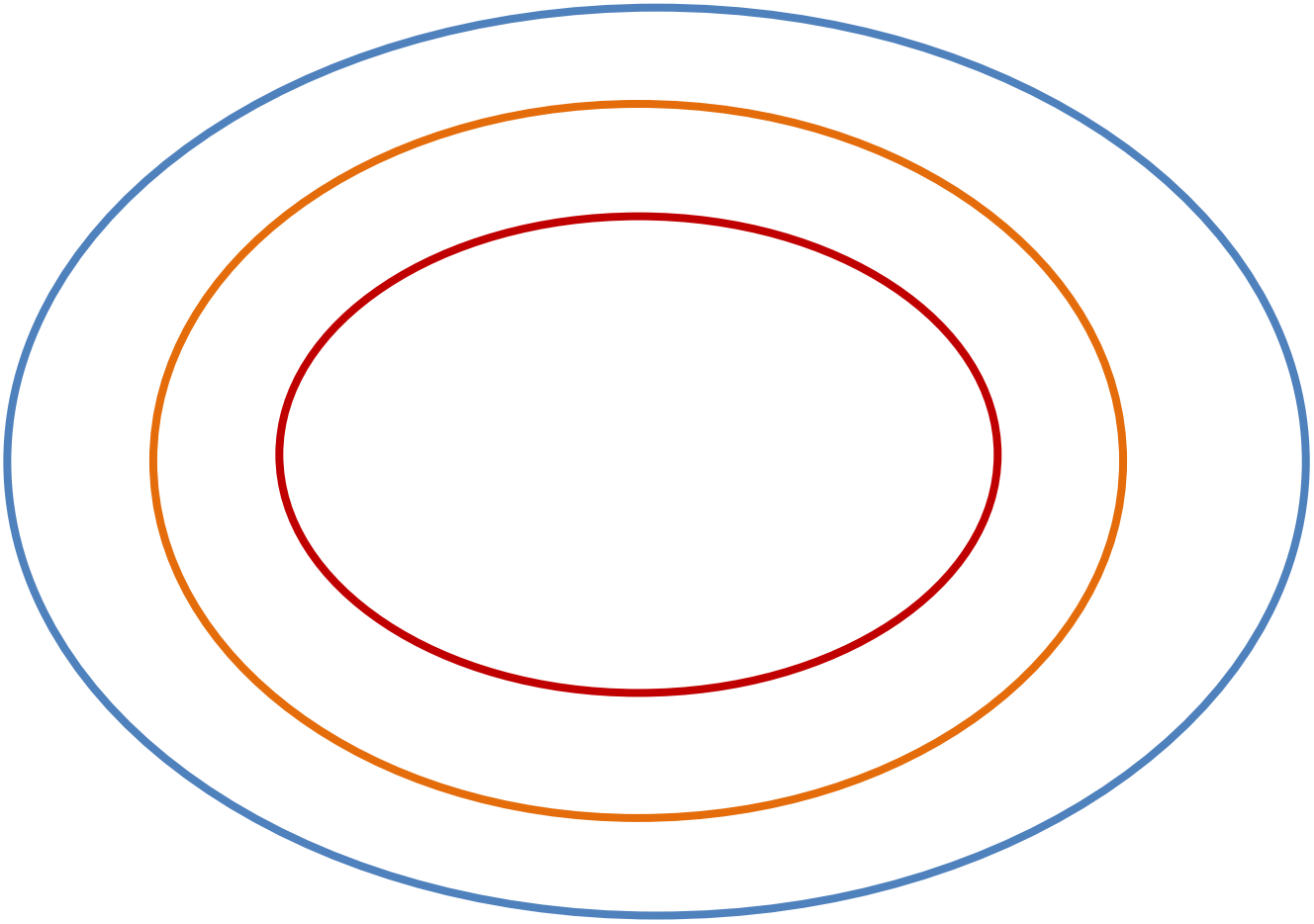
Based on your understanding of the Actiotope Model, complete this template from your own perspective:

Blue Circle = Environment

Orange Circle = Actions

Red Circle = Person

(include here Action Repertoire, Subjective Action Space, Goals)

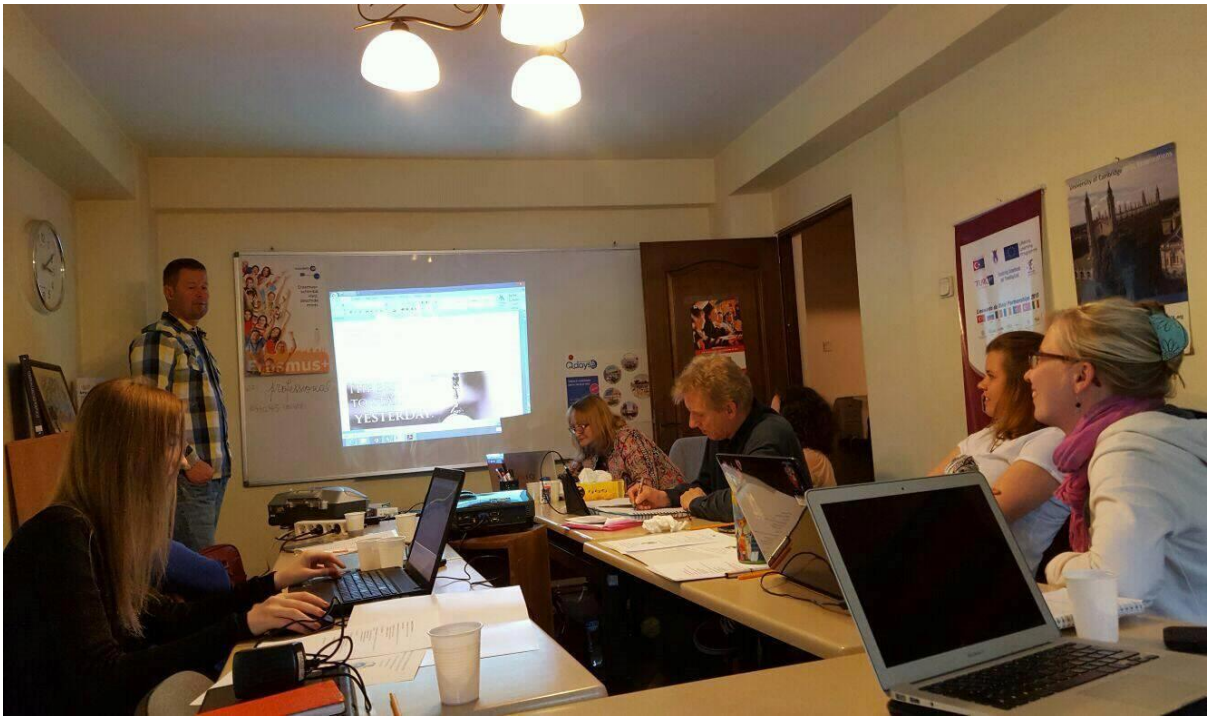


Partner's presentation

Professional Foundation is a non-governmental, non-political and non-profit foundation, established in 1998 with a view to promoting high quality in education, intercultural tolerance and appreciation, life-long learning, human rights, social inclusion. ProF is approved and accredited by the Ministry of Education for the section"Continuing Education" Ord.no. 3133/04.02.2000

It is a member of QUEST (The Romanian Association for Quality Language Services) which is an associate member of EAQUALS (The European Association for Quality Language Services). It is also a member of ACWW (Associated Country Women of the World) as it upholds the human dignity and well-being of women including internally displaced persons, refugees, and migrant women.

Being very much involved in the young people's training, ProF has been concerned with quality assurance in language education and gender equality through its courses and seminars. It has a wide network of schools (Transylvania Economics College, Vocational Art School, Gh.Sincai Technological High School) and the local universities. They are associated partners and the source of the target groups for pre-service and in-service Training Courses and Training for students/pupils.



Lesson Plan One: STEAM Methodology Approach

Learning Objectives:

- to raise awareness of teachers of their gender conscious and unconscious biases in educational activities
- to counter gender stereotypes in STEAM education and give girls more interest in STEAM orientations

Learning outcomes:

By concluding this session participants will have:

Knowledge to:

- Compare and contrast teachers behaviour concerning gender bias in STEAM class

Skills to:

- Identify skills which will engage more girls in STEAM

Attitudes to:

- Demonstrate a change in approaching gender bias in STEAM class

Activities :

1) Lead In: Suitcases Time:15'
(see the Description of the Activity & Handout 1)
2) Guidelines for teachers:
Constructivist Theory (Handout 3) T: 30' (f2f or 1h online)
3) Project Based Learning (Handout 4) T:30'(f2f or 1h online)
4) Questionnaire for students
5) PBL put into practice: 60' f2f (Ts will play the role of ss)
- 1st Session – 2h20' (when piloted)
- Inter-session workload – 3hs (when piloted)
- 2nd session – 1h40'(when piloted)
6) Reflection Grid T:15'
7) Free Feedback T:10'

Stereotypes & Counter Arguments

IV Steam is not for girls.

IV.CA1: Since the introduction of ART in STEM many opportunities open for girls.

IV.CA2: There is a new (somehow imposed)attitude towards girls and women in STEAM career paths.

Description of the activities:

1) Suitcases

Participants are asked to write their: Expectations/ Feelings /Contribution on the handout "suitcases". Using blue tack they will be displayed around the classroom and each participant will take a look at the others' suitcases. (relaxing music).It is a good way to get to know each other. At the end of the course they will receive their suitcases back and they will have to write again, this time after completing the training. The suitcases remain with the trainer.

GUIDELINES FOR TEACHERS (online or face-to-face)

2)Constructivist Theory – Video film Q&A
https://www.youtube.com/watch?v=MBMawqyW2sc&t=50s
- Discuss the usability of the CT in STEAM
- Discuss the usability of the CT in STEAM

To look from a different perspective at our training and avoid the traditional class GE-STEAM's didactical approach for TP is using **the Constructivist Learning Theory** with everything which it consists of.

Here we have designed a YouTube video which explains this theory in short. Let's watch it:
https://www.youtube.com/watch?v=69jV1ggHdPw&rel=0 (3'.56")
Discussion: f2f/online
Time:15'
Q. **What are the characteristics of a constructivist class/training?**
A. (ideally)

- the learners are actively involved
- the environment is democratic
- the activities are interactive and student-centred
- the trainer facilitates a process of learning in which trainees are encouraged to be responsible and autonomous

Q. **Furthermore, in the constructivist learning, how learners work primarily?**
A. In **groups** and learning and knowledge are **interactive and dynamic**.
Q. **How can you explain the focus on social and communication skills, as well as collaboration and exchange of ideas?**
A. This is contrary to the traditional classroom in which students work primarily alone, learning is achieved through repetition, and the subjects are strictly adhered to and are guided by a textbook.
Some activities encouraged in constructivist classrooms which you could noticed so far are: (these definitions are hanged around the classroom in big capital letters and they will read them in turn or are projected by a video projector on a screen)

- **Situated learning:** In contrast with most classroom learning activities that involve abstract knowledge which is out of context,Lave argues that learning is situated; that is, as it normally occurs, learning is embedded within activity, context and culture. It is also usually unintentional rather than deliberate. Lave and Wenger call this a process of "legitimate peripheral participation"
- **Problem - based learning (PBL)** is a student centred pedagogy in which students learn about a subject through the experience of solving an open-ended problem found in trigger material Learners individually perform an experiment and then come together as a class to discuss the results.
- **Discovery learning/Explorative learning:** This allows learners put the concepts and ideas discussed in class in a real-world context by observing, discussing, trying out and reflecting on them. The self-developed experience strengthens self-confidence and arouses curiosity about further experiences.
- **Films and Inquiry learning** are about finding appropriate resolutions and thus questions and issues. Films provide visual context and thus bring another sense into the learning experience. Inquiry can be a complex undertaking and it therefore requires dedicated instructional design. Carefully designed inquiry learning environments can assist learners in the process of transforming information and data into useful knowledge. This technique is used in all of the methods described above. It is one of the most distinctions of Constructivist Teaching methods.

2) Project Based Learning Guidelines

See the video:
https://youtu.be/LMCZvGesRz8
https://www.youtube.com/watch?v=LMCZvGesRz8&feature=youtu.be

Discuss the usability of the PBL in STEAM. Skills developed in girls due to this approach: 4Cs
Communication / Collaboration / Creativity / Critical thinking. Finding out about Ts experience in PBL(Questions and answers/good practice) It is important to use PBL approach in STEAM with STEM strategies. Talking about the steps to follow for a well planned PBL.
Conclusion: Examples of the steps for a well designed PBL:
https://www.youtube.com/watch?v= 3yAODXnAsg&t=13s
Time: 10' 48"

VIII. Involve your students from the beginning (Brainstorming)
IX. Break down the intro well defined tasks (Inquiry Based Learning)
X. Plan well, set goals, define outcomes (encourage Ss to ask questions IBL)
XI. Divide your class into working groups with well defined tasks
XII. Create a tangible artifact as an outcome
XIII. Arrive at a conclusion
XIV. Document and present to a public audience

Starting the PBL by brainstorming and mind mapping with real life experiences/ local societal causes. Following the mentioned steps teachers will try to simulate PBL.

GUIDELINES FOR TEACHER'S PILOTING ON STUDENTS
Student Impact Assessment Questionnaire

(see Handout PBL applied in the class)

1st Session

Students are divided into five groups or how many are necessary. They receive a flipchart paper, felt pens, markers etc. Each group will choose a topic which is something they/their community/young people are very interested in. They will choose a name for the group:
E.g.

- The Environmentalists – Cleaner Air in Our Community
- The Social Workers – Food4All
- The Artists – We bring Art in the Community – ART HOBBY
- The Innovators – Innovation and Technology

The members of the groups which consist of both girls and boys will receive "tasks" (according to their skills and talents) which they will be happy to fulfill. They will follow the steps mentioned in the PBL Guidelines. The tangible artifact will be a Poster/a Video which will be advertised and campaigned on Facebook. (The class will initiate a FB page)

2nd Session

They will start the campaign in their school, networking, parents, and friends online. The more convincing project and the way of advertising will be classified First Prize. The more likes they will receive the better place they will get.

The time for this PBL will last for two weeks and will be monitored by the teacher who will play the role of a facilitator. It will involve work at home and recruiting volunteers and campaigning.
The results and the proposed projects will be presented as an "event" where school mates, head-teachers, decision-makers, mass media and parents will participate. An assigned Event Committee will write the invitations, deliver them and prepare the ceremony. Certificates and "prizes" will be prepared. A "jury" consisting of teachers and students will evaluate the "projects" according to an 'Assessment Sheet' where clear descriptors are devised by the Event Committee.
Each team will present their project, its development and the results, in a way which they will consider most successful as presentation will be assessed as well. After the teams project presentations the public will vote online and a team responsible for the public evaluation will communicate the result which will count for half of the entire result.
The 'president' of the Jury will announce the winners (first, second etc) handing in the certificates and congratulating all the participants. According to each organiser's creativity other "entertaining" events can be added during the break needed for the calculation of the results.
5. Reflection Grid: It is a process of systematic review. Time is allowed at the end of every session for participants to think over the activities they have just experienced and make notes under various headings: For us as a group/For us as teachers/For our work with students.
6. Free Feedback: Teachers will like to know how information on the content, process and atmosphere as well as how and what students feel they are learning. Five minutes before the end of the lesson students are given a small 10x10cm piece of paper on which they (teachers and later students) are asked to give their feedback on the lesson. This kind of feedback will be used with the participants as well. At the end of each session they will receive such pieces of paper on which to write their feedback. The slips will be redistributed at the beginning of the next session, asking participants to ensure that they do not receive their own and then in a seated circle they are invited to read out the slip they have. Others with slips containing a similar theme or comment will read theirs. It serves as a link, reminding the group what happened during the last session.

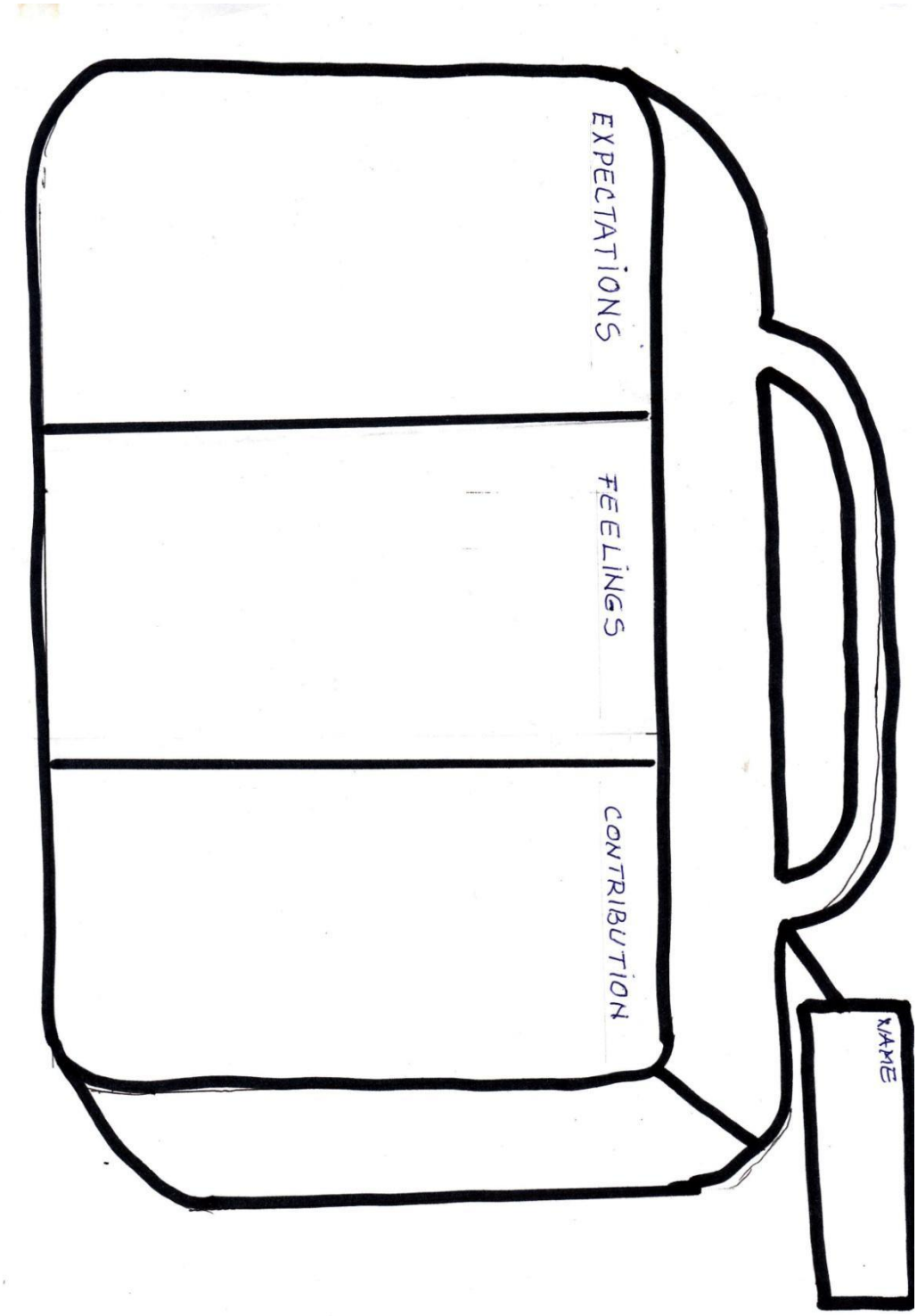
Recommended duration:
- This activity is f2f and online. Together will last for about 7hs
- It will be distributed in two weeks 'time.

Assessment Evaluation
- Self-evaluation
- Ss evaluation

Materials, equipment
Internet connection/BYOD
Flip chart paper
Post its
Markers
Handouts 1, 2, 3, 4

Resources:
https://en.danilodolci.org/news/project-based-learning-non-formal-youth-education/
Author's own experience.

Handout 1 Fill in the 'suitcase'. Stick it for the other trainees to see.



Handout 2. What is PBL methodology?

Project-based learning (PBL) is a student-centered pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems. Students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge, or problem. It is a style of active learning and inquiry-based learning. PBL contrasts with paper-based, rote memorization, or teacher-led instruction that presents established facts or portrays a smooth path to knowledge by instead posing questions, problems or scenarios. (Source: Wikipedia).
Learn more about PBL with this video: https://youtu.be/LMCZvGesRz8 and see Handout 2

Why do we use PBL methodology?

Project Based Learning in Blended Learning training for teachers/trainees
Why Project-based learning, complemented with blended learning? (*Blended learning* generally refers to incorporating online *learning* into training to create *hybrid-learning* experiences for learners).
Detailed procedures. It could be an effective method to achieve better teachers' (pupils) engagement, by transferring the focus on the learner, thus creating learner-centered activities, where core 21st century skills, like communication, collaboration, critical thinking and creativity are addressed. The use of the platform will allow the trainees to discover methods and teaching material ready to be used in class with their pupils.

Raise awareness of teachers on PBL (Optional)

- Discuss the usability of PBL in STEAM. Engaging girls in hands-on activities. Skills developed in girls due to this approach: 4Cs: Communication/Collaboration/Creativity/Critical thinking.
- Finding out about Teachers' experience in PBL. (Questions and answers/good practice)
- Eliciting from teachers/trainees is important. E.g.
  Q: Have you used PBL in your teaching? A: Yes/No
  Q: Which are the advantages? Are there disadvantages?
  Q: Can you adjust it to your teaching? Can you give us an example?
  Q: Which has been your latest topic taught in your subject (STEM) which you think will be appropriate for using PBL which involves pupils in all stages?
  Q: How can we plan this topic according to what you saw in the video?
  Q: Can you involve both girls and boys in teams? (Quantity is important but also responsibilities have to be divided equally).

- Detailed procedures
  Hands on activity: talking about the steps to follow for a well-planned PBL.
  NB. It is important to use PBL approach in STEAM with Inquiry Based Learning (IBL) in STEAM, strategies taking into account **gender sensitive language** and **gender equality and equity**. (Use the Flipchart):
  Q: Which are the steps you should use in a PBL approach? (Brainstorming). Trainer writes down on the flipchart sheet as the teachers come up with ideas. Then these ideas are selected, teachers put numbers in front of the most relevant tips, thinking of a logical order.

- Conclusion: examples of the steps for a well-designed PBL
  I. Involve your trainees/pupils boys and girls respecting equal numbers but also equal involvement from the beginning (Brainstorming)
  II. Break down the topic into well-defined tasks - Inquiry Based Learning https://www.youtube.com/watch?v=XbxDHqf883g
  III. Plan well, set goals, define outcomes (encourage participants to ask questions IBL)
  IV. Divide your class into working groups with well-defined tasks
  V. Create a tangible artifact as an output (something like an object, a poster, a map, a video, a robot, an IT application)
  VI. Arrive at a conclusion
  VII. Document and present to a public audience (school, local community)

Handout 3: Project Based Learning Methodology

At the heart of any STEAM class is the one in which students create products, not just take tests. Those products should be exhibited to their peers, teachers, parents, and adult experts. This step requires smart scheduling, presentation space, invitations, practice time for public speaking, and -- more than anything -- attention to the design process. Using **inquiry-based learning through real-life experiences** and socially relevant challenges will result in continual reflection and refinement of the product.

Allow for creativity. STEAM education is equated with innovation. But what really works? Incorporate a creativity rubric into your project. Use a rubric that has a 'breakthrough' category. This category is open-ended and encourages students to think outside the box.

Make teamwork central. Scientists and engineers work in teams, so emphasizing teams -- and training teachers and students in how to make teams successful in the classroom -- is essential to great STEAM education. To move from old notions of group work or cooperative learning into real teams, use a team collaboration and work ethic to help students identify the exact tasks associated with 21st century teamwork.

Start with questions. Any important endeavor in science, engineering, art or technology starts with a question. How do we create this product? What are the best design specs? What does the consumer want? An engaging, rigorous STEAM curriculum emphasizes questions, not rote learning, lectures, or regurgitating known information. A STEAM program can teach facts and information -- these are essential to young people. But make sure that students are constantly challenged by interesting, meaningful questions - with potential answers that matter to the world.

"**The 21st century skills and competencies"** are a combination of cognitive, interpersonal and intrapersonal characteristics that support deeper learning and knowledge transfers. Cognitive competencies and skills include critical, innovative and creative thinking. Interpersonal characteristics encompass communication, collaboration and responsibility. Intrapersonal characteristics include flexibility, initiative and metacognition ". (Honey et al., 2014)

Handout 4: Class Observation Sheet – Peer Mentors

Task1: Fill in the Class Observation Sheet and comment where appropriate:

Observation	GIRLS			BOYS		
Number	Responses Noted			Responses Noted		
	Number of responses	About Behaviour	About Learning	Number of responses	About Behaviour	About Learning
1						
2						
3						

Task 2: During each observation interval, note if the teacher uses, or does, any of the following:

1. Comments that suggest gender-role stereotyping (examples: "be neat like a girl", "well done for a girl").

   _____

   _____

2. Apparent assignment of any tasks or lesson activities according to student gender.

_____

_____

3. Use of sexist (or non-sexist) language in class, in handouts, or in tests. As possible, provide examples of any observed. [refer to handout from class]

_____

_____

4. Use of sexist humor. If observed, list examples. Also list any instances where a teacher might correct another person's use of sexist humor.

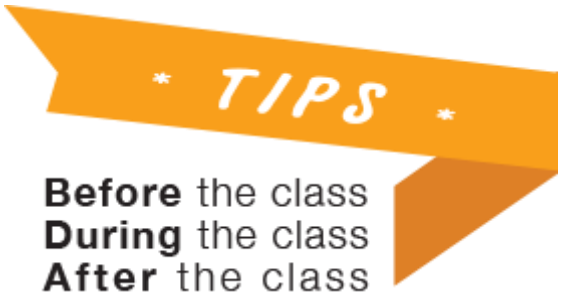
_____

_____

Handout 5: Reflection Grid

Reflection Grid: After each session a round-up discussion will be "unpacked" under three major headings:

For us as a group	
For us as a teacher/person	
For our work with students/pupils	

Lesson Plan Two: How to Introduce a STEAM Role Model	
Learning Objectives:	➢ To prepare the class for a Role model visit ➢ To give girls more interest in STEAM orientations
Learning outcomes:	By concluding this session participants will have: **Knowledge** ➢ To divide the activity into the phases: RM Pre-meeting activities, While-meeting activities and after meeting. **Skills** ➢ to identify skills which will engage more girls in STEAM **Attitudes** ➢ to demonstrate a change in approaching STEAM classes
Activities :	**Time f2f: 2h40'** 1. Pre-meeting activities - Guidelines for teachers: online 2. While-meeting activities - (f2f) 3. After- meeting activities – (f2f) 4. Questions for students (Piloting at the beginning and ending of piloting) 5. **Pilot scenario:**  6. Reflection Grid T:15' f2f 7. Free Feedback T:10' f2f
Stereotypes & Counter Arguments	I. ***Girls show an aptitude for Art and Humanities*** I.CA1. Girls have the potential to excel in STEAM subjects. I.CA2.There are many successful role models for girls in STEAM.
Description of the activities:	PRE-MEETING ROLE MODEL ACTIVITIES **Activity 1:**BRAINSTORMING Duration: 15' Teachers will prepare students for the meeting by asking students 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) Teacher 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. Role model profiles 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 student interest and help them understand that there are a variety of paths that lead to STEM careers.

WHILE-MEETING ACTIVITIES

Activity 2:

Duration:15'

INTRODUCTION

Warm welcome. Role model or 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, children.
- A short video (no more than 3-4min) 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 speakers ("What was he/she doing at my age?") and what they are experiencing right now.

Activity 3

Duration: 40'

WHAT COMES AFTER SCHOOL? (5')

Role models will show the students the different paths after high school to emphasize the multitude of avenues to get somewhere.

NB. Evoking, if that is the case with the Role model some more "chaotic" paths or any doubts they may have had to reach their current
professional situation.

PRESENTATION (5')

GENERAL 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?

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

PRESENTATION (10')

Role Model talks.

DEVELOPMENT OF THE ACTIVITY

First set, 15 min total, (5-minute presentation, 10 minutes for questions from students.)

• The speaker(s) will preferably begin with their studies:

o What did I like to study?

o How did I get to the job I have now?

o Why did I choose this course of study?

o What did I like about it?

o What aspects do I use today?

This part of the activity is interesting to help students identify with the speakers

o If I failed at something, how did I choose another path? Students will be interested in the wide range of individual experiences. It will reassure them there is more than "one way".

o If PhD student: What does doctoral student mean?

How did I become one? (studies, professional background, motivations), Who is paying me now (and how much)?

• It would be useful to show the students the different paths after high school in your country to emphasize the multitude of bridges to get somewhere (e.g. bridges between engineering schools and PhD degrees; short university degrees and long university degrees)

• It is also interesting to evoke, if that is the case for one of the speakers, some more "chaotic" paths or any

Student's possible questions:

MORE SPECIFIC QUESTIONS (15')

- 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 he/she working)
- Do you have a social life?
- 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?
- What is more specifically the content of your job?
- Is it innovative? Why is it interesting?
- Also, what is boring about it? What is
- challenging?
- What are your accomplishments/results? What do they look like, statistics?
- What is your role in civil society?
- Do you have any doubts or concerns about your job and your role? Does your job match your previous expectations?
- What are the basic qualities of a science specialist (may be the name of the job)?
- What is your future? (job prospects, openings)

	AFTER-MEETING ACTIVITIES **Activity 4** FEEDBACK What did you see? What did you hear? What did you feel **5) Reflection Grid**: T: 15' f2f It is a process of systematic review. Time is allowed at the end of every session for participants to think over the activities they have just experienced and make notes under various headings: For us as a group/For us as teachers/For our work with students. **6) Free Feedback**: T: 10' f2f Trainers/Teachers will like to know how information on the content, process and atmosphere as well as how and what trainees/students feel they are learning. Five minutes before the end of the lesson students are given a small 10x10cm piece of paper on which they (teachers and later students) are asked to give their feedback on the lesson. This kind of feedback will be used with the participants as well. At the end of each session they will receive such pieces of paper on which to write their feedback. The slips will be redistributed at the beginning of the next session, asking participants to ensure that they do not receive their own and then in a seated circle they are invited to read out the slip they have. Others with slips containing a similar theme or comment will read theirs. It serves as a link, reminding the group what happened during the last session.
Recommended duration:	This lesson is run **f2f and online**. Together will last for about 2hs (1h50')
Assessment/ Evaluation:	**Self-evaluation** - **KWL(H) Chart** (What we know, What we want to know, What we have learned, How we know it). T:15' **Handout 6** **Ts evaluation** – Feedback Dialogue on Feedback slips
Materials, equipment:	Internet connection/BYOD Flip chart paper Post its Markers Handout 1,
Resources:	Author's own experience.

Handout 1: Reflection Grid

Reflection Grid: After each session a round-up discussion will be "unpacked" under three major headings:

For us as a group	
For us as a teacher/person	
For our work with students/pupils	

Handout 2. Self-*Assessment: KWL Chart*

K What I already know	W What I want to find out	L What I learned

Lesson Plan Three: The Frisco Approach	
Objectives:	➲ to develop the ability to identify problems regarding gender equality in STEAM and to find simple and effective solutions ➲ to identify stereotypes referring to STEAM
Learning outcomes:	Based on this lesson the participants will acquire: Knowledge: ➲ to identify complex and difficult problems regarding choosing a career in STEAM ➲ to demonstrate how stereotypes affect self-perception and the behaviour of the person who is stereotyped Skills: ➲ to stimulate the empathetic capacities and critical thinking, focusing on imagination and creativity ➲ to encourage and practice the communication skills of thinkers Attitudes: ➲ to value arguments for and against the gender discrimination in STEAM
Stereotypes and Counter arguments	**II. Boys show an aptitude for how things work – linked to engineering work.** II.CA 1. Boys are given more opportunities to construct, build and fix things. (This is in the nature of toys they are encouraged to play with). II.CA2. Many women work in engineering too. (There are still opportunities for girls to work in this sector).
Description of the activities proposed:	2.1. **Activity 1. *The Frisco Method*** *T:* Duration: 60' 5 min – setting roles 10 min – analysis of statements and group discussions 30 min – plenary debate 10 min– drawing conclusions (flipchart) 5 min – self-evaluation ***Guidelines for Teachers:*** ***Q: What is the Frisco method?*** ***A :***It is based on the participants' performance of a specific role, covering a certain type of personality, approaching a problem from multiple perspectives. Thus, the members of the group will have to play, each of them, in turn, the role of the conservative, the exuberant, the pessimist and the optimist. **Q: Which are the stages of the FM?** A: I. *The stage of approaching the problem:* the teacher notices a problematical situation:

*Stereotype II:'***Boys are given more opportunities to construct, build and fix things** and suggest it should be analyzed.

II. *The stage of organizing the group:* roles are established: conservative, exuberant, pessimist, optimist and who plays them. Roles can be addressed individually or, in case of large groups, the same role can be played by several participants simultaneously, forming a team.

III. *The stage of collective debate*: each participant plays the chosen role and supports his/her point of view.

Description of the roles:

The person who is *the conservative* has the role of appreciating the merits of old solutions, suggesting their maintenance, without precluding possible improvements. E.g. The student impersonating this role will sustain that STEM is not for girls and since the ancient times men were the builders; there is no gain in involving girls in this job. Because girls are……

The exuberant looks to the future and issues ideas that seem impossible to be applied, thus providing an imaginative-creative and innovative framework, motivating the other participants to see the things in the same way, too. It is based on a phenomenon of contagion.

E.g: S/he will bring arguments for the fact that 21st c most important skills are the four Cs Communication, Collaboration, Creativity and Critical thinking and that those are not the attributes only of males; practically it doesn't have anything to do with gender. The future is open to everybody etc

The pessimist is the one who does not have a good opinion about what is being discussed, censuring the ideas and solutions that have been originally proposed. S/he highlights the negative aspects of any improvements. E.g. S/he will go back and develop the conservative ideas adding more examples of STEM as being a "man's profession" etc.

The optimist lights the shadow left by the pessimist, encouraging the participants to look at things from a real, practical and achievable perspective. S/he finds realistic fundamentals and opportunities of achieving the solutions proposed by *the exuberant*, stimulating the participants to think positively. E.g.more and more girls are enrolling for STEAM (BG&RO) at University level;STEAM disciplines are the present and the future of creativity and innovation and girls can experiment that as well. STEAM programmes can benefit society by increasing both girls and boys awareness of STEM etc.

IV. *The stage of systematizing ideas and concluding upon the established solutions.*

Materials, equipment:

- WiFi, Smart Phones/ Internet/ Videos/Websites
- Guidelines for the Frisco method

Recommended duration:

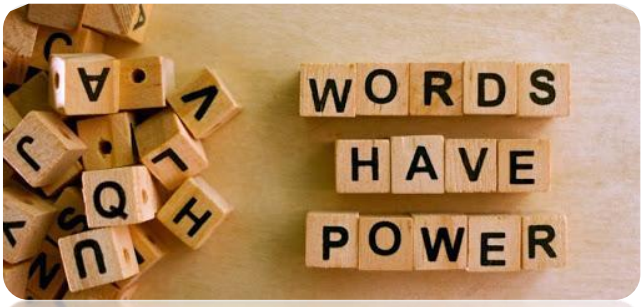
- One session of 1h

Assessment/ Evaluation:

- Debriefing
  - *How do you feel while impersonating a certain type of personality?*
  - *Do you feel your opinion has been respected and listened to by the group?*
  - *What are the main findings you came up with about gender equality and women access to STEAM opportunities?*

References and other useful sources:

https://www.pearson.ch/HigherEducation/Pearson/EAN/9780133747119/Critical-Thinking



Lesson Plan Four: The Power of Words

Objectives:

- To identify gender-based stereotypes and how they affect women/man choices, attitudes and behaviours
- To develop empathy

Learning outcomes:

Based on this lesson the participants will acquire:

Knowledge:

- to experience the consequences of being stereotyped; thus they will increase their ability to empathize with others.

Skills:

- reflect on how stereotypes and prejudices affect social models and behaviours.

Attitude:

- identify and value the emotions and feelings they experience.

Stereotypes and counter arguments

Stereotype I. **Girls show an aptitude for art and humanities**.

I.CA1. Girls have the potential to excel in STEAM subjects.

I.CA2.There are many successful role models for girls in STEAM.

.

Description of the activities proposed:

Activity 1. Watching a video: The Power of Words

https://www.youtube.com/watch?v=Hzgzim5m7oU 1'47"

Duration: 10'

Discussion on the video:

Q:Do words have power?

A:Words have energy and power with the ability to help, to heal, to hinder, to hurt, to harm, to humiliate and to humble."

Q:Do words create reality?

A:Everything begins with a word. **Words** consist of vibration and sound. It is these vibrations that **create** the very reality that surrounds us. **Words** are the creator; the creator of our universe, our lives, our **reality**.

Q: How do words inspire change?

A: A **word** has the power to **change** your life. Think about that for a moment because it is literally an Earth-moving statement – to **change** your life. ... **Words can** influence us, **inspire** us or just as

easily bring us to tears. **Words change** our relationships, our demeanour, our entire system of beliefs.

Activity 2 Labelling

Duration:50'

- 5 min. Introducing shortly the activity steps
- 20 min. Participants talk to each other, treating and behave according to their interlocutor's label.
- 10 min. Participants share their feeling with their labels on
- 15 min. Debriefing

Developing of the activity:

1.Attach a label on each participant's forehead (or back) so that the label is not visible to the wearer. Make clear that these labels are being assigned randomly and have nothing to do with students' actual attributes.

2. Choose labels/features that are culturally attributed to male or female (like, overemotional, fragile, aggressive, strong, comprehensive, etc.)

3. Then ask participants to spend 15 minutes talking with each other about "future career in STEAM" (another general topic can be chosen but this one works well in eliciting responses to the labels). Tell participants that they should circulate in order to talk with several different people, and that they should treat one another according to the other person's labelled attribute. For example, someone labelled "forgetful" might be repeatedly reminded of the instructions.

4. After 20 minutes, reconvene the group and ask participants to leave their labels on for a little while longer. Then ask participants to share how they felt during the exercise, how they were treated by others, and how this treatment affected them. Participants will often mention their discomfort not only with being stereotyped but with treating others stereotypically.

Debriefing: see evaluation

Materials, equipment:

- Sheets of paper
- Coloured pencils/markers
- WiFi, smartphones, laptop, video projector/TV

Recommended duration:

- One session of 1h

Assessment/ Evaluation:

- Debriefing (Q&A)

When you finish the activity, use the questions below to start a discussion in plenary:

- *Was the label what you guessed, or were you surprised by it?*
- *When people stereotyped you, were you able to disregard it?*
- *Did you try to disprove the stereotype? If so, did it work?*
- *How did you feel toward the person who was stereotyping you?*
- *If your attribute was positive (e.g., "good at math"), how did you feel?*
- *When stereotyping others, how easy was it to find confirming evidence?*

- *When stereotyping others, how did you react to* disconfirming evidence?
- *Do you think some of the labels are commonly associated with one gender (typically female or male)? Which ones? Why?*
- *As a girl or boy, how do you feel about being associated with this label because of your gender?*

References and other useful sources:

Activity available on VU ceptor Blog "*Stereotypes: labelling activity and cultural pursuit*" https://my.vanderbilt.edu/vucept/modules-open-sessions/stereotypes-in-my-community/
Adapted from Goldstein, S. B. (1997). "The power of stereotypes: A labelling exercise".

Handout 1 Labelling

The labels which teachers give to pupils can influence the construction and development of students' identities, or self-concepts: how they see and define themselves and how they interact with others. This in turn can affect their attitudes towards school, their behaviour, and ultimately their level of achievement in education.

Labelling refers to the process of defining a person or group in a simplified way – narrowing down the complexity of the whole person and fitting them into broad categories. At the simplest level labelling involves that first judgement you make about someone, often based on first-impressions – are they 'worth making the effort to get to know more', are you 'indifferent to them', or are they to 'be avoided'.

According to labelling theory, teachers actively judge their pupils over a period of time, making judgments based on their behaviour in class, attitude to learning, previous school reports and interactions with them and their parents, and they eventually classifying their students according to whether they are 'high' or 'low' ability, 'hard working' or 'lazy', 'naughty' or 'well-behaved', 'in need of support' or 'capable of just getting on with it' (to give just a few possible categories, there are others!). (*See criticism one below).

Annex 1. Questionnaire

1. Do I enjoy creating (making) something more than reading a book?
2. Do I like to solve and find solutions to the problems that I am having a hard time?
3. Do I like to help others when they need it?
4. For me, the most important way to learn new things is to read something about that subject?
5. Do I like manual labour?
6. Do I like being a boss?
7. Do I prefer to know all the data of a problem before I start solving it?
8. Do I like to take care of others?
9. Do I like to design, to invent new things?
10. Do I like to express myself through art?
11. Would I like a job where I could be in touch with others all day?
12. Do I enjoy working with materials and equipment?
13. Do I enjoy finding new things and ideas?
14. Does cooperation with others seem to me a natural state?
15. Do I look to find out how things work by disassembling them?
16. Would I choose to work with machines rather than people?
17. Do I usually succeed in influencing people to do things my way?
18. Do I like to build and repair objects?
19. Do I like the research I need to carry out my projects?
20. Do I enjoy getting in touch with people?
21. Do I look to find new ideas and ways of doing things?
22. Do I seek the opinion of others?
23. Do I like to learn how to use various tools / equipment?

Interpretation of the questionnaire:

If you have circled the statements 1, 5, 9, 12, 15, 16, 18, 23 - you like the world of objects you have knowledge about it, in it you can handle it. Mechanical construction, repair and maintenance, transport, crafts and technology attract you.

If you have circled 3, 6, 8, 11, 14, 17, 20, 22 - for you the area of interest is people. You like to care for or help others, convince or interview people, work as a team, lead or respond to others. The occupations that characterize you are from the following fields: medical, education and training, assistance and counseling, religion.

If you have circled the statements 2, 4, 7, 10, 13, 19, 21, 24 - you are concerned about the written information. You like to express yourself in writing, music or art, do experiments or research on a topic, find solutions or answers to puzzles, study or read. You will find jobs in the following fields: business and finance, scientific research, sales. and services, tourism, law.

Annex 2. Questionnaire

SCHOOL DISCIPLINE	YOU CAN BECOME
Language and literature	foreign languages: Teacher, linguistics researcher, teacher, librarian, educator, guide, translator, journalist, etc.
Mathematics / computer science	Teacher, economist-accountant, engineer, bank official, astronomer, computer scientist, etc.
Physics, chemistry, biology	teacher, researcher, doctor, pharmacist, biological etc.
History	Teacher, writer, musicologist, policeman, etc.
Physical education	Sports teacher, coach, army officer etc..
Arts and technologies	Teacher, painter, designer, modeller, designer, architect, musician, actor, popular folk etc.

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LICENCE

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