Technology
Arts Sciences
TH Köln

FEMSTEAM MYSTERIES: STEAM SCENARIO TEMPLATE

Title

FemSTEAM Mysteries inspires our comic!

Authors

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Summary

The scenario aims to help students to value and respect the gender difference and the equality of rights and opportunities between them, reject stereotypes that discriminate between men and women, develop students' key skills in the use of information sources in order to acquire new knowledge with a critical sense, to conceive scientific knowledge as an STEAM integrated knowledge, which is structured in different disciplines, as well as to know and apply the methods to identify problems in the different fields of knowledge and experience, to develop entrepreneurial spirit, participation, critical sense, personal initiative and the ability to learn to learn, plan, make decisions and take responsibilities, to know and accept the functioning of one's own body and appreciate artistic creation and understand the language of different artistic manifestations.

The context of the scenario is the school where students should create a comic as a mural for a wall (or in this case the doors of the toilets) where they will paint their STEAM role-models. The scenario has these main activities:

1. *Motivation to the project of creating a comic as a mural cover the doors of the toilets.*
2. *Playing with FemSTEAM Mysteries game and further reflection to break down stereotypes about scientists*
3. *Looking for information about the STEAM role model of their comic*
4. *Analysing the proportions of the human body, its symmetry.*
5. *Measuring the width and height of the doors where the comic should be painted.*
6. *Scaling the lengths of the doors to be painted in the comic.*
7. *Scaling the proportions of the different parts of the body using Leonardo Da Vinci principles of mathematical beauty of the human body.*
8. *Creating the narrative of the comic*
9. *Creating the role-model of the comic*
10. *Colouring the comic.*
11. *Presenting the comic to their classmates and describing which*
12. *Electing the best comic.*
13. *Getting money to execute the sketch*
14. *Painting the best comic in the doors.*
15. *Self-assessment of the project*

The expected STEAM learning outcomes are:

a. *To value the contribution of science to society and the work of people dedicated to it regardless of their ethnicity, gender or culture, highlighting and recognizing the role of women scientists.*

European Commission

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b. *Scientific project: Scientific work and people in science: contribution to biological sciences and social importance. The role of women in science.*
c. *Human anatomy and physiology*
d. *Explain their own plastic and visual productions, comparing them with those of their peers and with some of those that make up the cultural and artistic heritage, justifying opinions and taking into account the progress from the intention to realisation, in order to value exchange, shared experiences and intercultural dialogue, as well as stereotypes.*
e. *Analyse different plastic, visual and audiovisual proposals showing respect and developing the capacity for observation and internalisation of the experience and aesthetic enjoyment, in order to enrich individual artistic culture and nourish the imagination.*
f. *Explore the techniques, languages and intentions of different cultural and artistic productions, analysing, in an open and respectful way, both the process and the final product, its reception and its context, in order to discover the diverse possibilities, they offer as a source for generating ideas and responses.*
g. *Produce individual or collective artistic productions with creativity and imagination, selecting and applying tools, techniques and supports according to intention, in order to express one's own vision of the world, emotions and feelings, as well as to improve communication skills and develop critical reflection and self-confidence.*
h. *The creative process through plastic operations: reproducing, isolating, transforming and associating.*
i. *Factors and stages in the creative process: choice of materials and techniques, making sketches.*
j. *Basic techniques of graphic-plastic expression in two dimensions.*
k. *Interpret, model and solve problems of everyday life and mathematical problems, applying different strategies and ways of reasoning, to explore different ways of proceeding and to obtain possible solutions.*
l. *Identify the mathematics involved in other subjects and in real situations that can be approached in mathematical terms, interrelating concepts and procedures, in order to apply them in different situations.*
m. *Recognise the contribution of mathematics to the progress of humanity and its contribution to overcoming the challenges of today's society.*
n. *The contribution of mathematics to the development of different areas of human knowledge from a gender perspective.*

The driving question is: Which is the best comic that presents a STEAM-role model absent of stereotypes?

Subjects

- Arts was chosen by the potential that gives to the transdisciplinary nature of STEM providing a creative thinking to the students.
- LIBDI will provide students with the ICT knowledge and the linguistic and multilinguistic competence to write the narratives of the comic.
- Science and specifically biology will provide students with scientific knowledge about the anatomy and physiology of the human body to draw a comic not biased on the presentation of their role-models.
- Mathematics and proportionality from an algebraic and geometric approach to provide students with accurate proportions for the role-models that they draw.

Real- life questions

The real-life questions that students will attempt to respond are, driving from "*Which is the best comic that presents a STEAM-role model absent of stereotypes?" are*:

- Are the figures drawn in the Primary school bathrooms' models of reality?
- What are the expertise and uniqueness of FemSTEAM Mystery game role-models?
- What are the important contributions or achievements of these people?
- How do these people promote gender equality?
- Which is the anatomy and physiology of a human body?
- Which is the width and height of the doors to paint the comic?
- Which scale should be used to paint the comic?
- Which is the narrative of the comic?
- Which role-model will I present?
- Which colours should I use?
- How did the activity help me to break the stereotypes of STEAM people?
- Do you want to study further STEAM subjects and/or a career? Explain: what and why.

Aims of the scenario

The scenario aims:

- *to help students to value and respect the gender difference and the equality of rights and opportunities between them,*
- *to reject stereotypes that discriminate between men and women,*
- *to develop students' key skills in the use of information sources in order to acquire new knowledge with a critical sense,*
- *to conceive scientific knowledge as a STEAM integrated knowledge, which is structured in different disciplines, as well as to know and apply the methods to identify problems in the different fields of knowledge and experience,*
- *to develop entrepreneurial spirit, participation, critical sense, personal initiative and the ability to learn to learn, plan, make decisions and take responsibilities,*
- *to know and accept the functioning of one's own body and appreciate artistic creation and understand the language of different artistic manifestations.*

Connection to STEAM careers

The students would develop critical and creative thinking about FemSTEAM Mysteries role-models and the careers, research and professions that they have.

Age of students

12-13 years old

Time

Preparation time: 1 hour

Teaching time:

- **Preparation: 1 hour**
- **STEAM Biology: 1 hour**
- **STEAM Mathematics: 1 hour**
- **STEAM Arts: 3 hours**

Assessment time: 1 hour

Teaching resources (material & technological tools)

Materials:

Measuring tape, drawing instruments, tempera paints

Online tools:

FemSTEAM Mysteries game

Webpage information about STEAM role-models

21st century skills

This educational scenario will enhance among the students the following skills, defined as 21st century skills:

- Collaborative work will help to increase student's competence in linguistic communication, because students should interact in oral and written form in a coherent appropriate manner for different communicative purposes: present their beliefs about STEAM-role models, describe the anatomy and physiology of their selected role-model, discuss which scale should they use to construct the comic, present their comic and write about their learning and expectations.
- Mathematical competence will be developed through the problem-solving skills to decide which is the best scale to draw the comic.
- Science, technology and engineering competence will be increased through the use of the anatomic knowledge of the human body and the scientific method to solve the main problem that guides the scenario and the design based-engineering process when designing the comic for the mural or doors.
- Digital competence will be enhanced through the Internet searches that the students do using criteria of quality, timeliness and reliability, selecting results critically about STEAM-role models and archiving them, in order to retrieve, reference and reuse them for designing the STEAM role-model included in the comic.
- Concerning the civic competence, the students will enlarge their critical thinking, their understanding and analysis of the current problem of STEAM careers and vocations, critically considering their potential and their enjoyment to continue studying STEAM careers and how this will help to empower men and women.
- The entrepreneurial competence will be developed at the same time as increasing the creative thinking when designing their comic adapted to the needs of creating a mural or a paint for the walls or doors of the school.

- The competence in cultural awareness and expression will be developed through the understanding and respect of how the ideas, opinions, feelings and emotions about gender equality in STEAM are expressed through the comic on FemSTEAM Mysteries role-models.

Teaching approaches and learning strategies/theories

List and justify the main teaching pedagogies and strategies you will apply and their relationship to the FemSTEAM Mysteries role-model game-based approach to gender equality in STEAM.

Educational scenario

Name of activity	Procedure	Time
1st Lesson: Motivation to the project		
Brainstorming and discussion	Brainstorming and discussion about the differences between the doors of the bathrooms of Primary and Secondary level with the aim to discuss and answer: Are the figures drawn in Primary School Bathrooms' models of the reality?	15'
Discussion and preparation for the next lesson	Discussion about the role-models that students and teachers have through the visioning of the video I'm a scientist (https://www.youtube.com/watch?v=E0ZFXUpZ0-Y) and presenting students the project of designing a comic on STEAM role-models to be painted in the doors (or mural in the school walls)	15'
2nd Lesson: Playing with FemSTEAM Mystery game		
STEAM Subject Mathematics	*Informing students that they will play a game with the aim of learning biographical facts about FemSTEAM-role models.* *Playing with rooms 1 and 8 of the FemSTEAM Mysteries Game.* *Summarising the main information of the two selected role models using the information page of the FemSTEAM Mysteries Game.* *Discussion on:* *What are the expertise and uniqueness of FemSTEAM Mystery game role-models?* *How do these people promote gender equality?* *How a comic could help to promote gender equality and vocations to study STEAM subjects?*	60'
Learning products	*Individual document of all about the biographical facts of the role-models selected in the game and individual answers to the three questions posed for the discussion*	
3rd Lesson: Her/his innovation!		
STEAM Information and communication technology	Remember from the previous lesson the two role models that they got some information Work with the activity "Her innovation" included in Instructional Guide on Role-model education for promoting gender equality in STEAM (FemSTEAM Mysteries document included in the Library of the project)	60'
Learning products	*Google drive document with the story created by each team of students, that will help to create the narrative of their comic 3*	
4th Lesson: Anatomy and physiology of the human body		

Name of activity	Procedure	Time
STEAM Biology	Which is the anatomy and physiology of a human body? Analysing the proportion of the human body, its symmetry	1 h
Learning products	*Google forms with the answers of the question*	
5th Lesson: Scaling the doors		
STEAM Mathematics	Problem solving: Which scale should I use to paint the comic? Measuring the width and height of the doors where the comic should be painted Scaling the lengths of the doors to be painted Scaling the proportions of the different parts of the body using Leonardo da Vinci principles of mathematical beauty of the human body	*1 h*
Learning products	*Table with all the measures and scales to be used in the comic*	
6th Lesson: The comic		
STEAM Arts	Reflective answer of the questions: Which is the narrative of the comic? Which role-model will I present? Which colours should I use? How did the activity help me to break the stereotypes of STEAM people? Designing and painting the comic	*3h*
Learning products	*The comic*	
7th Lesson: Presentation of the comic		
STEAM Mathematics	*Presenting the comic to the classmates and describing it* - *Presentation to the classmates to elect the best comic* - *Presentation to the headmistress to get money to paint it*	*1 h*
Learning products	*Assessment of the evolution of their beliefs*	

Assessment

Initial assessment

Individual document of all about the biographical facts of the role-models selected in the game and individual answers to the three questions posed for the discussion

Formative evaluation

- *Google drive document with the story created by each team of students, that will help to create the narrative of their comic*
- *Google forms with the answers of the question*
- *Table with all the measures and scales to be used in the comic*
- *The comic*

Final assessment

Assessment of the evolution of their beliefs, answering the questions:

- *How did the activity help me to break the stereotypes of STEAM people?*
- *Do you want to study further STEAM subjects and/or career? Explain: what and why*
- *How can your comic help others to study further STEAM subjects?*

Student feedback

After two months of the scenario implementation students were asked for their feedback. Students were able to recognise what STEAM meant. Nevertheless, the fact that the scenario was implemented in English made them to confuse if it was an integration of Engineering or English subject.

Students were able to recognise that the comic was created "through the history of two people". They were able to remember the name of the FemSTEAM Mysteries role-models, profession, and main biographical details.

When asked how these two role-models broke the stereotypes, they were able to recognise their equalitarian gender role. When asked why we selected Carlos Pacheco and Elena García Armada. They answered: "*By the equalitarian gender role", "because it was a comic without stereotypes".*

And, they explained about general stereotypes:

- In the bathroom doors: *"there are princess"*
- Clothes: "the blue and pink, but far away on the time it was at the inverse"
- Games: "Barbies and a football ball"
- Jobs: "A man who is a cook"

Teacher feedback

Arts teacher:

I only had three hours to work on the comic with them, two of which were devoted to explaining the most basic elements to get them started. However, there was not enough time to explain the whole Prezi so that the children could work on it.

As far as the students' perception of learning is concerned, many of them showed quite a lot of interest in the comic. In the two hours that I have been in this course, I have been asked several times who the winner is.

Information and communication teacher:

How did the classes you gave develop?

The development of the proposed activities mainly encouraged three key competences

key competences:

- Competence in linguistic communication

Once all the information had been collected, the students had to carry out a reading comprehension to decide what was essential and what could be used.

reading comprehension to decide what was essential and what could be used to make the comic.

From this point onwards, and having prepared a synthesis work, the students started with the work of students began with the written production work to narrate the story that they would later

which would later be captured in the comic.

- Learning to learn competence

During all the sessions and activities that corresponded to this part of the learning situation, the pupils

learning situation, students were developing their competence to learn to learn. It remains as a competence that encompasses the other two.

- Digital competence

Guidelines were established for the search of information through specialised websites on the biography of the specialised websites on the biographies of the characters in question. It was

It was agreed to look for information about their scientific contribution and why they were

recognised. The idea was to elaborate a narrative based on the actions of the protagonists.

of the protagonists.

What was your perception of the students' learning?

The activity, designed for students in 1st ESO, met the expectations we had set for it. It is adapted to the needs of the students, It is flexible with the different levels of attainment.

My perception as a teacher is that the pupils have been able to take advantage of the

and the circumstances for its development. The communicative competence in English has served as a thread to link different subjects which they have managed to work on in an integrated way without having anything in common a priori.

The pupils have been able to achieve the proposed goals and the level of attainment has been progressing, which is why, from my point of view, this type of activity is useful for the development of competences.

Annexes

Annex I: Anatomy and physiology of the human body

Annex II: Her/His innovation

Annex III: Motivation

Annex IV: The comic

	FemSTEAM Mysteries inspire us! Anatomy and physiology of the human body?	**Annex I**

Description of activities
Which is the anatomy and physiology of a human body? Analysing the proportion of the human body, its symmetry

Flipped classroom

First of all, read the text individually and underline in the text the parts of the human body and share with your colleagues in the group. Secondly, once you have finished, complete the information in the image and finally watch the video to build the knowledge and self-evaluate within the group.

Activity A

1º Underline in the text the parts of the human body and share with your colleagues in the group.

The part of the human body comes in lots of different shapes and sizes, but most are made up of the same parts which do the same jobs. We all have a skeleton. The bones in your skeleton help you stay standing up and let you move around. They also protect the important organs inside you. Your ribs keep your heart lungs and stomach safe and your skull acts as a tough shell for your brain, keeping everything safely wrapped up in your skin. Most of us have the same kind of body parts in the same places. You have a head and a neck, you have arms, elbows, hands and fingers. You have a chest and a tummy, you have legs, knees, feet and toes. Some of us might need help to make our bodies work better. For instance, you might need a little extra help to hear or to get around whoever you are. The best way to keep every part of your body healthy is lots of exercise.

2º Complete, the following image with the information from the text above.

3º Watch the video Parts of the Human Body. Check and improve within the cooperative group the information in the picture that all the correct information is correct.

BBC Learning - Parts of the Human Body

Activity B

1º Underline in the text the parts of the human body and share with your colleagues in the group.

The major organs of the human body contain lots of different organs all working together each with their own special job to do inside. Your head, protected by your skull, is your brain. It does all your thinking and tells the other parts of your body what to do. It is your heart which pumps blood around your body. Your lungs are protected by your ribcage and they bring air in and out of your body. Your stomach digests your food, breaking it down ready for your liver to help digest it and store the nutrients. Your liver also cleans your blood before your kidneys filter it all the waste and is finally passed on to your intestine, so we can leave. Your body, of course, not all your organs are inside your body. For example, your skin is your largest organ and it does lots of different jobs. It holds everything together in a protective waterproof layer. Plus it stops germs and dirt getting into your body and has sensors to tell you about your environment such as how cold or hot it is. To keep all your organs working well you need to eat a healthy balanced diet, drink plenty of water and do lots of exercise.

2º Complete the following image with the information from the text above.

3º Watch the video Major Organs of the Human Body. Check and improve within the cooperative group the information in the picture that all the correct information is correct.

BBC Learning - Major Organs of the Human Body

Activity C

Last but not least, complete the questionnaire which you have the link to below.

https://forms.gle/QVB4qq7EdsgZRUZK9

Extra: Printed worksheet

Printed worksheet

Resources:

Images of Keynote apple
Drive
Google doc
Google form
https://www.bbc.co.uk/learningenglish/
https://dictionary.cambridge.org/es/

	FemSTEAM Mysteries inspire us! Her/His innovation	**Annex II**

Question of research: What are the important contributions or achievements of these people? Which is the narrative of the comic?

Description of the activities
1. Remember from the session of mathematics who were the two role models that you played with to discover who they were. 2. Create a google drive document, title it His/Her innovation, share it with who are the teachers of this transdisciplinary unit) 3. Look for information that will help you to draw your comic on internet about: ● Carlos Pacheco Perujo ● Elena García Armada
4. Summarize the information that you have found and you want to include in your comic 5. Write the narrative of your comic

	FemSTEAM Mysteries inspire us! Motivation to the project	**Annex III**

Questions of research:

Which is the best comic that presents a STEAM-role model absent of stereotypes?

- *Are the figures drawn in the Primary school bathrooms' models of reality?*
- *What are the expertise and uniqueness of FemSTEAM Mystery game role-models?*
- *What are the important contributions or achievements of these people?*
- *How do these people promote gender equality?*
- *How did the activity help me to break the stereotypes of STEAM people?*
- *Do you want to study further STEAM subjects and/or a career? Explain: what and why*

Descripción de Actividades[(6)] (Búsqueda de información, organización, análisis y producción):

FemSTEAM Transdisciplinary Unit, S1: Motivation

1. Brainstorming and discussion about the differences between the doors of the bathrooms of Primary and Secondary level with the aim to discuss and answer: Are the figures drawn in Primary School Bathrooms' models of reality?

2. Discussion about the role-models that students and teachers have through the visioning of the video I'm a scientist (https://www.youtube.com/watch?v=E0ZFXUpZ0-Y) and presenting students the project of designing a comic on STEAM role-models to be painted in the doors (or mural in the school walls)

FemSTEAM Transdisciplinary Unit, Playing with FemSTEAM Mystery game:

3. Playing with rooms 1 and 8 of the FemSTEAM Mysteries game.
4. Discussion on:
    a. What are the expertise and uniqueness of FemSTEAM role models that you have been playing with?
    b. How do these people promote gender equality?
    c. How a comic could help to promote gender equality and vocations to study STEAM subjects?

5. Preassessemt:

- Summarize the main information of the two selected role-models: Carlos Pacheco and Elena García
- Individual answer to the discussion questions:
    - What have you learned with the game?
    - How will the game help you to construct your comic?
    - How the game is helping you to understand STEAM stereotypes?

FemSTEAM Transdisciplinary Unit, Lesson 5: Scaling the doors

1. How will you solve the problem: Which scale should I use to paint the comic?
2. Analyzing the geometry of the doors
3. Measuring the doors
4. Deciding which will be the best scale
5. Scaling the lengths of the doors to be painted
6. Watch carefully the next video and answer the next questions:
   Da Vinci's Vitruvian Man of math - James Earle
    a. Which are the figures which inscribe the Vitruvian men?

   b. Which is the formula of the area of a circle?
   c. Which is the formula of the area of a square?
   d. Which is the center of the circle that Leonardo constructed?
   e. What does it mean: “Vitruvius recognized that the length of the arm span and the height have nearly perfect correspondence in the human body? Which will be this ratio?
   f. What does it mean that we divide the Universe in half?
7. Which scale should we use for drawing the STEAM role-model?
8. Scaling the main lengths of your body as an example for the dimensions of the STEAM role model that you will select:
   a. Height
   b. Arm span
   c. Head
   d. Legs
   e. …

FemSTEAM Transdisciplinary Unit, Lesson 7: Presentation of the comic

1. Presentation the comic to the classmates to elect the best comic because it has the best:
   - Narrative
   - Anatomy and physiology
   - Use of scales
   - Art design: color, form,..
   - Break of STEAM Stereotypes
2. Assessment of the students’ beliefs evolution:
   - How did the activity help me to break the stereotypes of STEAM people?
   - Do you want to study further STEAM subjects and/or career? Explain what and why.
   - How can your comic help others to study further STEAM subjects?

	FemSTEAM Mysteries inspire us! The comic	**Annex IV**

Questions of research:
Which is the narrative of the comic?

Which role-model will I present?

Which colors should I use?

How did the activity help me to break the stereotypes of STEAM people?

Description of activities
1. Motivation: Students are asked to think about what they have done in the other subjects to inspire the design and execution of the comic and answer the following oral questions: a. What text have I prepared for the comic? b. What is the STEAM reference I will present (Carlos or Elena) and why? c. What colors will I use? d. How will I make the comic break stereotypes about STEAM people?
2. Design of the comic
PREZI: https://prezi.com/c4cf5lktnssp/el-comic/?present=1 - Analysis of the plastic representation of the human figure through examples. - Explanation and analysis of the human figure. The Canon. - The human proportion I. Explanation of the movement in the human figure.
Explanation figure in the comic. Character design. The canon: Styles and characteristics.
Character design. Gestural expression. Kinetic codes.

BASIC INDICATIONS TO DRAW A COMIC. Essential elements of a comic page. ICONIC ELEMENTS: Worked from the area of Plastic Arts. THE VIGNETTE THE CHARACTERS (GESTURES) THE KINETIC CODES THE BALLOON OR SANDWICH. IDEOGRAMS AND VISUAL METAPHORS. VERBAL ELEMENTS: Worked from other areas. Story line. LITERARY SCRIPT: Worked from LIBDI.
Technical Script: Types of shots and points of view of each vignette. Adding text and balloon type.
Planning by pages of the comic. Sketches of the spatial planning of the vignettes per page, 6 per page (approximately), according to the technical script. External aspects of the vignettes .
1- Comic book production: 2- Design of vignettes by pages. Use of square and bevel. Street of 0.5 cm. 3- Placing characters and balloons. Type of balloons. Planned from the technical script. 4- To draw a complete comic. To color with watercolors and to review lines with black pilot color 0,5 mm.