FEMSTEAM MYSTERIES: STEAM SCENARIO TEMPLATE

Title

FemSTEAM Mysteries and Gladys West inspire us for our mapping the school app!

Authors

Katerina Papanicolaou, Oliver Mannay, Mercia Agamemnonos, Katerina Kekkouri, Andrea Pagdati, Persefoni Skouroumouzourou, Daniella Evripidou, Nicoletta Nicolaou, Hercules Panayiotides

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.

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 an app that will map the school and guide students and staff to the room they need to be.*
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 our app*
4. *Determining the measurements of the top floor of the school.*
5. *Scaling the school to the dimensions needed for the app.*
6. *Draw the scale model of the school.*
7. *Create the app.*
8. *Presenting the app to the rest of the school.*
9. *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.*
b. *Scientific project: Scientific work and people in science: contribution to biological sciences and social importance. The role of women in science.*
c. *Correct measuring, scaling, and creating an app.*
d. *Produce individual and collective measurements of the school premises, selecting and applying tools for correct scaling, selecting and applying tools to create the best app posible.*
e. *Factors and stages in the creative process: choice of materials and techniques, making sketches.*
f. *Basic techniques of graphic in three dimensions.*
g. *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.*
h. *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.*

This document is issued within the frame and for the purpose of the FemSTEAM Mysteries: A Role-Model Game-Based Approach to Gender Equality in STEAM project, funded by the European Commission-Erasmus+/ Key action 2, Cooperation for Innovation and the Exchange of Good Practices/ KA201 - Strategic Partnerships for school education (Ref. #: 2020-1-CY01-KA201-066058). The information and views set out in this document are those of the author(s). Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

i. *Recognise the contribution of mathematics to the progress of humanity and its contribution to overcoming the challenges of today's society.*
j. *The contribution of mathematics to the development of different areas of human knowledge from a gender perspective.*
k. *Recognise the contribution of computer science to the progress of humanity and its contribution to today's society.*

The driving question is: Which is the best way to give instructions going from one point to the next?

Subjects

- Science to provide students with the knowledge of Gladys West, the GPS system, and her own contribution to its creation.
- Mathematics and proportionality from an algebraic and geometric approach to provide students with accurate proportions for the role-models that they draw.
- Computer Science to provide students with knowledge about apps, QR codes and other tools needed to create the app.

Real- life questions

The real-life questions that students will attempt to respond are:

- What are the expertise and uniqueness of FemSTEAM Mystery game role-models?
- What are the important contributions or achievements of these people?
- How does these people promote gender equality?
- What are the dimensions of the school?
- Which scale should be used to create our school model?
- Which role-model inspired us?
- How did the activity helped me to break the stereotypes of STEAM people?
- Do you want to study further STEAM subjects and/or a career?

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 in STEAM careers*
- *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 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,*

Connection to STEAM careers

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

The main point of Gladys West's reflections on her life and career is that "…anybody can be an engineer." The intent is for students to understand this at a functional level, and that this applies to them, whether their chosen field is engineering, medicine, art, or anything else.

Age of students

11-12-year-olds

Time

Preparation time: 1 hour

Teaching time:

- **Computer Science: 2hr 15 min**
- **Mathematics: 45 min**
- **Science: 45 min**

Teaching resources (material & technological tools)

Materials:

School map templates

Online tools:

FemSTEAM Mysteries game

Webpage information about STEAM role-models

Microsoft PowerPoint

21st century skills

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

- Mathematical competence will be developed through the problem-solving skills to decide which is the best scale to draw the model.
- Science, technology, and engineering competence will be increased through the use of the use of technology in order to create their mapping app.
- 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 than 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 role-models.

Teaching approaches and learning strategies/theories

- Students will work as self-directed learners during the FemSTEAM Mysteries game, with the aim of learning more about how STEAM practitioners can be from any group or personal identity.
- The technology behind GPS will be taught at an age-appropriate level.
- The emphasis of the Science portion of this project will be on Gladys West and her work toward the GPS standard, as she is, in effect, the focus of this project (a focus that could easily be overlooked with the other technical and mathematical components involved).

Educational scenario

Name of activity	Procedure	Time
1st Lesson: Playing with FemSTEAM Role-models		
Computing	*Informing students that they will play a game with the aim of learning biographical facts about FemSTEAM-role models.* *Playing with the rooms 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?*	45’
2nd Lesson: Her innovation!		
Science	What is GPS and how does it work? - This NASA video is helpful and mostly age-appropriate: https://youtu.be/RSA3feQ9gKk - There is also a written explanation, which can be found here: https://spaceplace.nasa.gov/gps/en/ - *Students only need to know the basic details of GPS; the actual physics and mathematics behind its working are far outside of the scope of this lesson* Look at the contribution of Gladys West to the GPS system. - Show this video of Gladys West describing her career and how anybody can be an engineer (2 mins): Calculating the Future - YouTube - *The file FACTSHEET FOR REFERENCE - Gladys West could be helpful in preparing for this part of the lesson* How is GPS used today?	45’

Name of activity	Procedure	Time
	OPTIONAL: Students can research Gladys West on their smartphones (if available, and if time allows).	
Learning products	Understanding of the basics of GPS Knowledge of the work of Gladys West as an engineer and as a major contributor to the creation of the GPS standard	
3rd Lesson: Calculating room areas		
Mathematics	Using the provided measurements, using a single 40x40cm floor tile as a unit, calculate the size of each of the rooms and fill them in on the provided map template. *Hand out the template sheet, which should be printed in advance, from the file Secondary Second Floor (Room Areas)* TASK: Complete the template sheet. It is up to the teacher as to whether areas need to be calculated in cm^2 or m^2. *NOTE: There is no need to leave the classroom, as the templates show the width and length of each classroom in tiles.*	45 min
Learning products	*Calculating area* *Converting non-standard units into standard units* *Completed template*	
4th Lesson: Making the interactive map		
Computing	Show the exemplar map PowerPoint on the board, demonstrating how it works (clicking on semi-transparent rectangles to go to 'about' pages, and going back using a BACK button). *The exemplar file is called TEACHER EXEMPLAR COPY - Completed Mapping App.* Be sure to note that each shape covers several classrooms (and that they will not have to make one linked shape per classroom, as they would quickly run out of time).	*90 min*

Name of activity	Procedure	Time
	Demonstrate how to: - Create transparent shapes (use 50% transparency) - How to link shapes (using the Link option in the context menu) to other slides - How to create a BACK button (using Action Buttons) Students open the template file, which contains the necessary slides, ready to be linked together and filled in. *The filename of the template is Mapping App Template* *There is also a file showing the subject name for each room, which can be found in the file Secondary Second Floor (Subjects). This can be distributed to students, or just displayed on the board during the task.* Students use PowerPoint, with slide links attached to transparent shapes, to provide clickable hotspots from key points on the map to relevant pages containing further information (along with BACK buttons to return to the map). Students should use the desktop PowerPoint app, and NOT PowerPoint Online for this, to ensure that all tools work correctly and consistently. *The purpose of this mapping 'app' is to serve as a resource for new students, so that they can look up each room and find their way around the school more easily. It is only a prototype (for example, it only covers one floor of the school).* OPTIONAL: If required, the teacher may choose to allow students an additional lesson to complete this task well. Ensure students submit their completed apps electronically, either through email or through the Class Notebook.	
Learning products	*Completed interactive map.*	

Assessment

Students will be mainly assessed by the quality of the mapping app they produce. Informal assessment of the career and professional work of Gladys West will also be performed, as well as how well students understand that careers are open to them regardless of who is considered the 'usual' type of person for that career.

Initial assessment

Informal assessment of understanding and appreciation of work and lives of role models from the FemSTEAM Mysteries game.

Formative evaluation

- *Table with all the measurements to be used in the app*
- *Functionality and quality of app produced*

Final assessment

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

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

Student feedback

The students are expected to provide feedback on how the lessons were received and implemented.

- Students enjoyed the practical nature of the task, specifically the Computing task where they linked the map template PowerPoint together and added the details they had calculated. It was different to anything they had done before and made a nice change from the usual pace of lessons.
- Many students thought the game was 'cool'. The class was split, roughly 50-50, on whether the control scheme worked or whether a WASD-style control layout would have been better.
- Fewer people remembered the role model and the details of her life as compared with the other scenario they experienced (Stephanie Bendixsen, in *Holding on to your Passion in Life*), but those who did were more impressed with Gladys West, due to the greater impact she made in her career and the extra challenges she would have faced as a person of colour.

Teacher feedback

The teachers are expected to provide feedback on how the lessons were received and implemented.

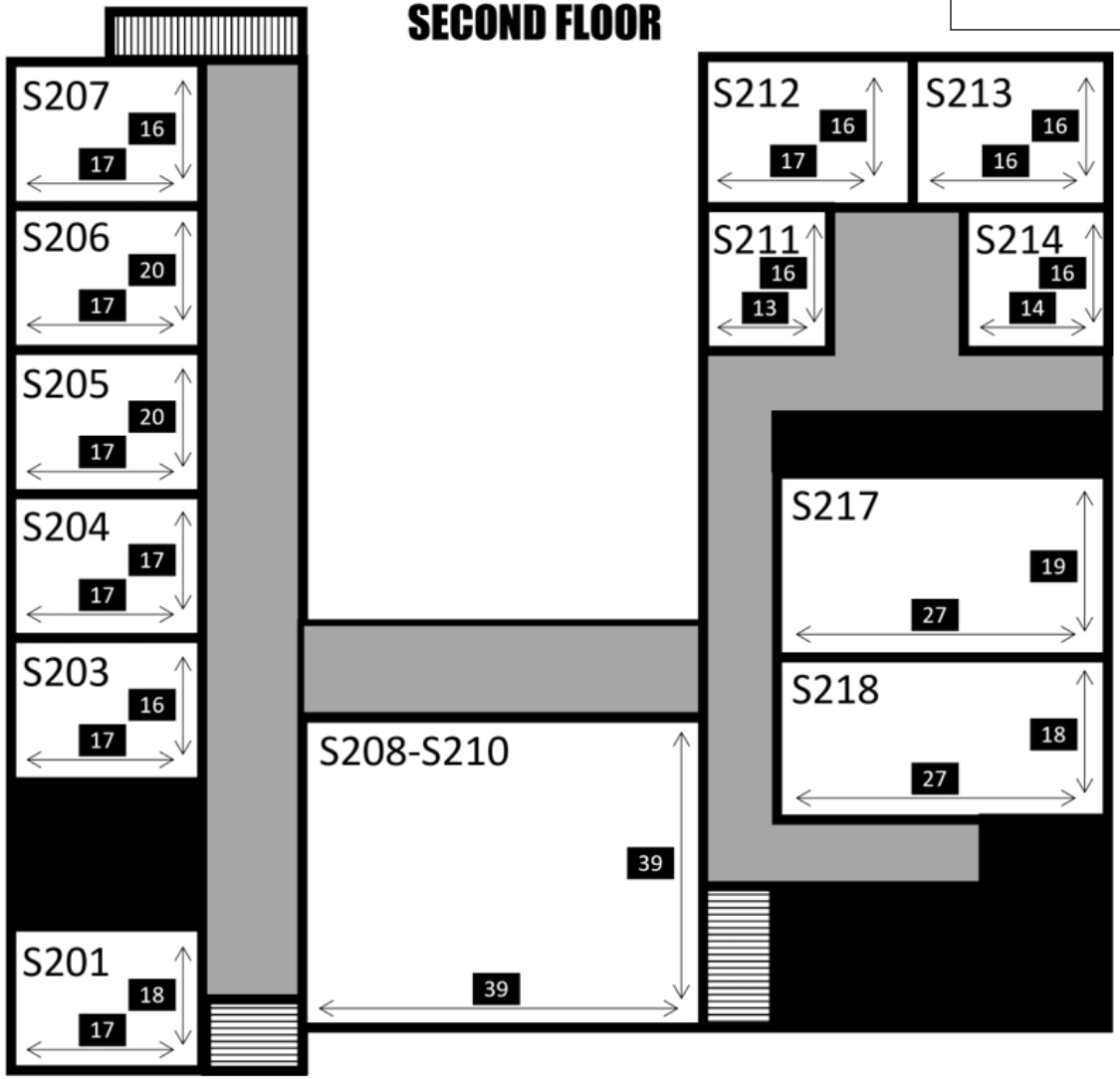
- Teachers found it easy to implement this project, as the templates had all been made for them and they could simply pause their normal teaching schedule, run the lesson, and resume teaching as normal.
- The computing lessons were quite fast-paced. To complete the whole task in a single lesson requires a high-ability class who listen well. For classes who work more slowly, or with more interruptions, allocate a double lesson instead.
- Students were happy to spend time playing a game instead of having their normal Computing lesson, but the actual impact of the activity appeared to be low, in that few students were impacted by the role models featured and the manner in which they were presented.
- Naturally, the mapping task would have to be customised to be taught in another school. Creating a map template and taking measurements is a time-consuming task. If more student time can be allocated, and classes are attentive and engaged, some of this can be taken on by the students instead.

Annexes

Here, a thorough and complete list of worksheets and other materials used in the scenario should be provided. These resources should be cited as Annexes and they can be further cited within the learning scenario.

SECONDARY SCHOOL

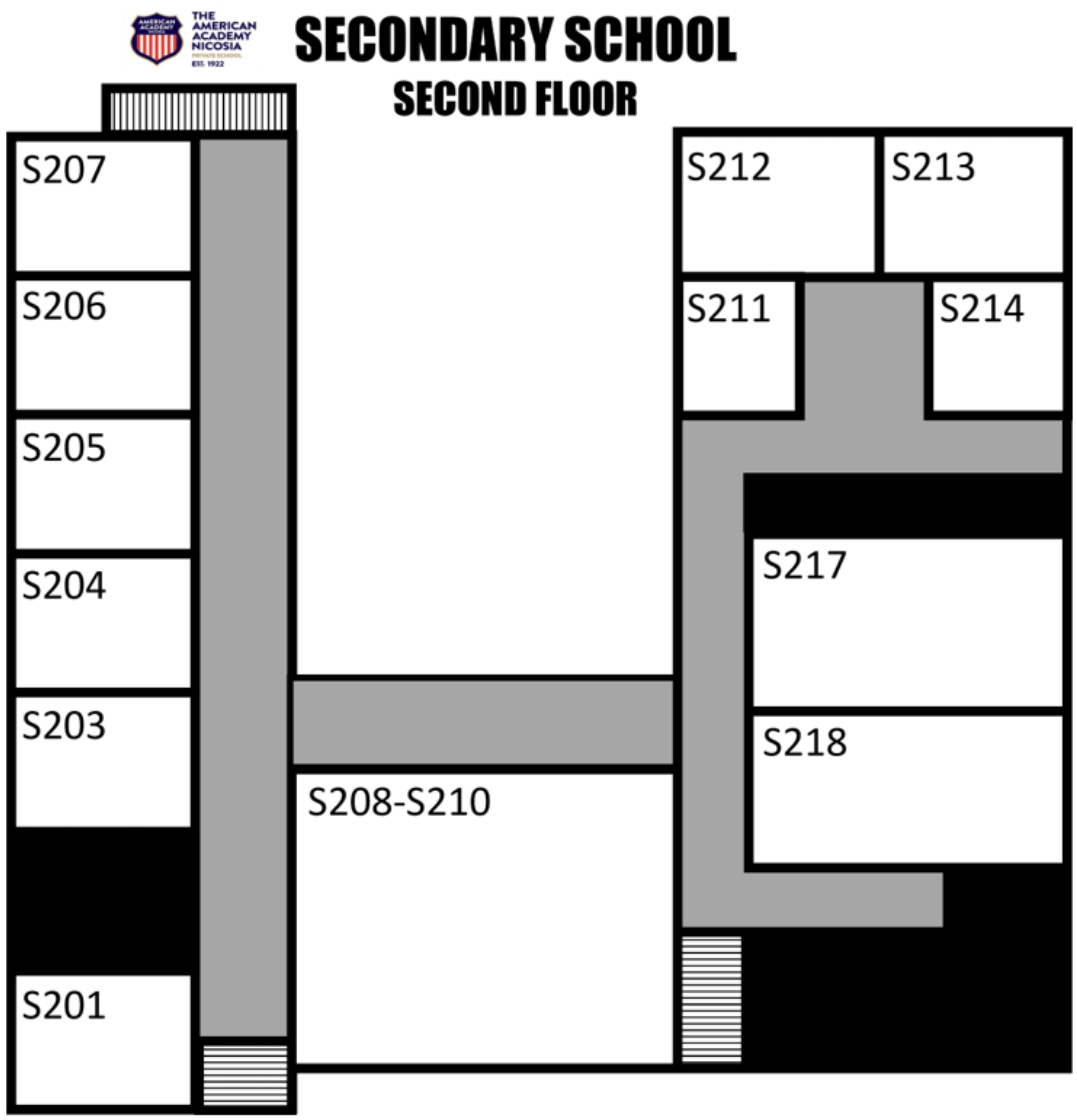
SECOND FLOOR



Fill in the table below by calculating the area of each classroom.
The numbers in black show the length and width of each classroom, in tiles.
Each tile is **40cm** long and **40cm** wide.

Room	Area
S201	
S203	
S204	
S205	
S206	
S207	
S208-S210	
S211	
S212	
S213	
S214	
S217	
S218	

This document is issued within the frame and for the purpose of the FemSTEAM Mysteries: A Role-Model Game-Based Approach to Gender Equality in STEAM project, funded by the European Commission-Erasmus+/ Key action 2, Cooperation for Innovation and the Exchange of Good Practices/ KA201 - Strategic Partnerships for school education (Ref. #: 2020-1-CY01-KA201-066058). The information and views set out in this document are those of the author(s). Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.



Room	Subject
S201	Business
S203	History
S204	Accounting
S205	Science
S206	English
S207	Economics
S208-S210	Music
S211	Greek
S212	Psychology
S213	Greek
S214	Greek
S217	Biology
S218	Computing