

# **STEAM in Computer Science Studies**

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# Outline

Steam : Active

- **STEAM-Active** project
- **STEAM** definition
- Teaching-Learning sequences (TLS)
- Implementation of TLSs
  - Cycling Tour and Tourism
  - Enjoy Sailing in Greek Islands
- Results
- Conclusions





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The **STEAM-Active project** has **two main aims**:

- Support engineering lecturers to use <u>innovative teaching methodologies</u> and develop students' competencies to meet the labor market needs
- Fight gender inequality both in higher education and in companies

**Target groups:** University engineering teachers, engineering students.

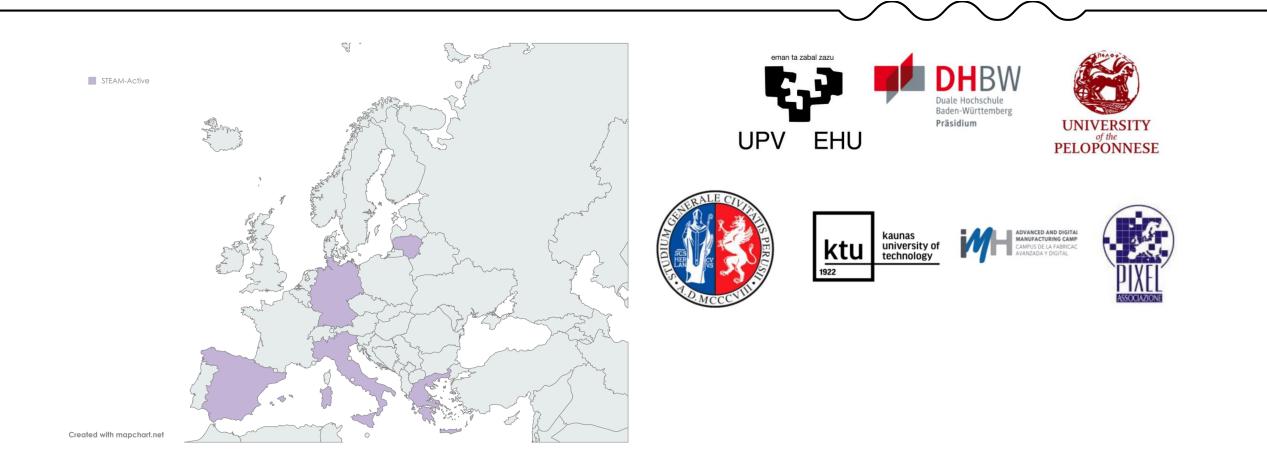


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# **Partners**





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# **Project Output**



IO1. Bibliographic review and **Protocol for Teachers** 



## IO2. E-learning course for teachers

#### E-Learning Course



**Basis of STEAM** Nowadays STEAM is a widely used acronym in the teaching ontext. STEAM projects are associated with active learning. fun, value for society, and diversity. However, the meaning of STEAM can vary with respect to the goals and the environment the acronym is used. To make this acronym more approachable. Module 1 covers the basis of STEAM, its evolution, features, and integration levels in practical application



STEAM Active approach This module deals with the "Ingredients of STEAM-Active methodological approach", "Ingredients of STEAM-Active eaching techniques approach" and "Teachers characteristics/ingredients to be good applying STEAM-Active approach in our teaching".



## Basis for designing a STEAM Active

This third module starts by explaining the design protocol,

## projecth

expanding on the new terminology and how the contents of the previous modules are applied in the protocol. To better understand the design process, there will be an example of a STEAM Teaching-Learning Sequence. The importance of this guide will be highlighted by presenting the learning objectives of each activity, the recommended didactic technique for their development or the evaluation.

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# IO3. A Collection of STEAM-based Teaching-Learning sequences

#### Home / Learning Sequences

#### Learning Sequences

A Collection of STEAM based Teaching-Learning Sequences that allow teachers to guide students in applying a project based learning methodology to solve socio-scientific-technological situations



#### Cycling tour and Tourism

Introduce the concept of micromobility in modern municipalities Micromobility is one of the areas where modern municipalities should invest. Cycling is in the middle of circular economy and it needs to be integrated not as a physical exercise (only) but as a way of liv ...

#### Planning the Placement of Recycling Containers



Contributing to circular economy by planning the placement of the recycling containers in the urban area with considering the network of the recycling points and the local features such as buildings and population density

#### Battery systems in electric transportation



The TLS will guide students through the intricacies of designing a battery system for electric transportation. The sequence begins with an exploration of fundamental concepts, including energy density, charging infrastructure, and battery technologies. Students then eng ..



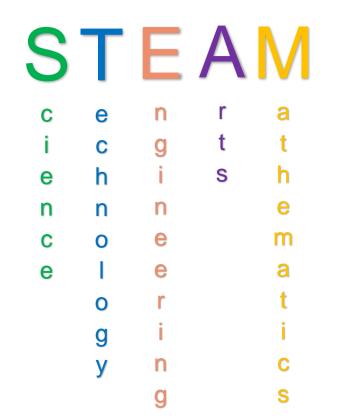
#### Pick and place of pharmaceuticals for preparation of daily dosage in a medication organizer

Pick and place of pharmaceuticals for preparation of daily dosage in a medication organizer



Study of the efficiency of machining processes on machine tools. Identify the most competitive machining process based on a number of criteria of lower energy consumption, process speed and machine efficiency.





In the scope of the **STEAM-Active** project:

STEAM is a problem-based learning (PBL) methodology which covers at least two disciplines of the acronym, focuses on the reallife context, and takes into consideration circular economy and fighting gender inequality.

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Number: 2021-1-ES01-KA220 PR3.B - TLS Cycling tour and Tourism University Name University of Study Programme 🖾 Bachelor 🗆 Master 🗆 PHD Name of the programme Study Year tegration Type 3. Axes to consider This part will be completed with the proposals of each partne Number of students Intro Micro Same number of female/male student Changing leadership roles (Changing between diff shou ring the project Project Topic needs of livi that y Selection of topic with a gender perspective Having the participation of female STEAM prot of the authors cited in the men, through of any female authors and why is it impo 7 Low /7 Medium X Hia ame (and not only the nalysis in the energy) etals, oil-plastic esearch and Analysis Collective report writing Collaboration discussion ere, water, soil, noise) Low 
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- Description of the context
- Possible strategies to integrate transversal axis

**Teaching Learning Sequences (TLS)** 

- TLS details (guiding question, learning objectives, pathway, ...) •
- Matrix to provide relationship between different stages of the TLS

  - Detailed description of activities
- Scheme of evaluation







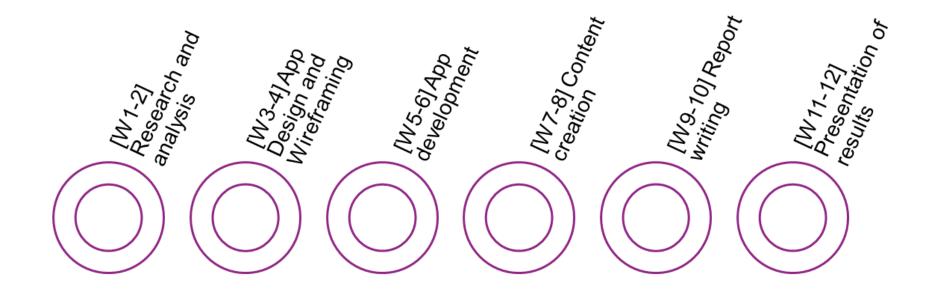
TLS			Guiding question
Cycling	Tour	and	What problem or project needs to be solved in order to promote cycling as a way of
Tourism			living and integrate it into modern municipalities?
Sailing	in	Greek	How can we leverage mobile technology to promote sailing tourism in the Ionian
Islands			Islands, with a special emphasis on encouraging the active participation of women, while providing a comprehensive guide to sailing routes and a rich selection of culturally, touristic, and commercially interesting Points of Interest (POIs) for both male and female participants?

- designed for the 3rd year bachelor students of the "Electrical and Computer Engineering" study programme
- cover technology, engineering, and arts disciplines
- 3 ECTS, 12 weeks



# **TLS Timeline**





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# **TLS Implementation**



- integrated into course "Artificial Intelligence and Decision Making" (6 ECTS) of the master study programme "Artificial Intelligence in Computer Science" as a group project (25% of final grade)
- cover technology, engineering, arts, and mathematics (AI) disciplines
- slightly modified timeline
- 6 groups of 4-6 students (teaching language: English)



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# **TLS Cycling Tour and Tourism**





**TASK.** Introduce the concept of micromobility in modern municipalities. Micromobility is one of the areas where modern municipalities should invest. Cycling is in the middle of circular economy and it needs to be integrated not as a physical exercise (only) but as a way of living. Students should prepare a report and design a mobile app that will promote cycling routes across the country combined with points of interest (POIs) of cultural, touristic and shopping interest.

- Include personal stories and testimonials
- Consider the environmental impact
- Make women-related POI (landmarks, art and culture, monuments and memorials, etc.) more visible as the womens' impact to the society is usually underappreciated
- Consider financial / technical / monitoring challenges, strategy to keep the users engaged...

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Group	Description	Al-solution
Group		
Α	An application to select a cycling route with	Convolutional neural network (CNN) for image
	customers' interests defined by the uploaded	classification into predefined categories;
	images. The application employs gamification	Random forest for recommendations using users' location
	approach as clients get rewards for achieving	and CNN classification result as input.
	their objectives (e.g. completing routes)	
В	An application to generate a personalized	K-means clustering to create "example users";
	cycling route by defining level of interest in	<b>Q-learning</b> to create a route.
	specific category, such as history, arts, nature,	
	fun activities.	
С	An application to generate a personalized	Natural language processing algorithms for filtering the
	cycling tour related to a specific topic, e.g.	descriptions of POIs;
	women artists. Users' experience is enhanced	Similarity-based recommendations for routes.
	with starring route recommendations.	



# **TLS Enjoy Sailing in Greek Islands**





**TASK.** Sailing and Greece are two words that can work proper together. Also, tourism applies as one economic sector where sailing can help the most during summer. Students should design a mobile app that will promote sailing tourism in Ionian Island with special focus in women (to make society aware about the historical and current impact made by women as it is usually underappreciated). The app should present sailing routes combined with points of interest (POIs) of cultural, touristic and shopping interest.

- Include personal stories and testimonials
- Consider the environmental impact
- Make women-related POI (landmarks, art and culture, monuments and memorials, etc.) more visible as the womens' impact to the society is usually underappreciated
- Consider financial / technical / monitoring challenges, strategy to keep the users engaged...

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Group	Description	Al-solution
D	An application to suggest personalized sailing	Term Frequency-Inverse Document Frequency (TD-IDF) for
	itineraries and POIs. The application includes	user feature description.
	interactive features (forums, user generated	Similarity-based recommendations for routes using cosine
	content) and gamification (rewards,	distance matrix.
	discounts, exclusive access).	
E	An application to suggest a sailing route with	Modified genetic optimization approach to generate
	specified categories of POIs.	routes.







- several students left the course and one of the groups left with only two members.
- time management and sharing of responsibilities, as students in one group started developing different projects.
- lack of ideas on how AI solutions can be integrated to the system.
- lack of data possible to train machine learning models.
- **difficult to transfer into the local context**, lack of relatable experience, low number of sailing experts to provide field-specific feedback.



# **Students' Feedback**



- improved practical skills and knowledge of integration of AI and technologies used in similar systems.
- demonstrated creativity by ensuring balance between users' engagement and financial sustainability.
- increased self-confidence to face the future challenges by finding creative ways to solve ones.
- improved **communication and time management skills**.
- understood the importance of **responsibility and individual impact** to the project.
- made new friends.

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- TLS adaptation to the specific course and context can lead to covering other (or more) disciplines from STEAM acronym.
- Students' feedback on the task was **positive**.
- STEAM activities can be **successfully integrated** in computer science studies by solving practical tasks.





# Q&A

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