LEARNING PROGRAMME

The STEAM Education Paradigm – Developing Physical Computing Applications with Arduino

10-DAY COURSE

50 learning hours | Course programme

The STEAM Education Paradigm – Developing Physical Computing Applications with Arduino – 10-Day Course

Introduction and Description

The course *"The STEAM Education Paradigm – Developing Physical Computing Applications with Arduino"* offers an in-depth theoretical and pedagogical examination of how integrated STEAM education can reshape learning in technologically dynamic school environments. Positioned at the intersection of science, technology, engineering, arts and mathematics, the course conceptualises STEAM not merely as a curricular addition, but as a holistic paradigm that cultivates learners' capacity to think across disciplinary boundaries, engage in authentic problem-solving, and construct personally meaningful knowledge through creative technological production.

Grounded in constructivist, sociocultural and constructionist perspectives, the programme interrogates how learners develop conceptual understanding through hands-on manipulation of materials, collaborative experimentation, and iterative cycles of design, testing and refinement. Participants explore how physical computing—particularly through the accessible Arduino ecosystem—serves as a powerful mediating tool for bridging abstract scientific principles with tangible, learner-generated artefacts. Through progressive engagement with basic electronics, digital logic, sensors, actuators, microcontrollers, robotics and introductory IoT systems, teachers develop both conceptual literacy and technical fluency that enable them to design robust, inquiry-driven STEAM learning experiences.

The course also foregrounds the critical role of creativity and the arts within STEAM. Participants analyse how aesthetic decision-making, storytelling, design thinking and multimodal expression can deepen learners' cognitive engagement and enhance the communicative power of technological artefacts. Emphasis is placed on understanding how integrating artistic processes broadens participation, supports diverse learning identities and promotes inclusive educational environments.

Throughout the course, educators examine empirical research, case studies and contemporary frameworks for computational thinking, data literacy, digital fabrication and future-oriented skills. They critically reflect on equity, accessibility and ethical considerations associated with educational technologies and IoT systems, particularly within school settings. Supported by expert facilitation, participants engage in guided prototyping activities that gradually extend into independent project development, culminating in the creation of functional Arduino-based artefacts designed for educational use.

By synthesising research-informed pedagogy with practical design work, the course equips teachers to conceptualise, implement and sustain STEAM approaches within their institutions. Graduates of the programme are prepared to scaffold learner autonomy, cultivate motivation and curiosity, and orchestrate collaborative, interdisciplinary problem-solving processes that reflect both real-world technological practices and the broader aims of transformative, future-oriented education.

Methodology and Assessment

The course employs an experiential, constructionist methodology in which participants learn through exploration, experimentation and iterative project work. Short lectures introduce core concepts, while hands-on workshops with Arduino boards, sensors and actuators enable immediate application. Collaborative problem-solving, peer learning, and guided prototyping support the development of confidence and technical fluency. Reflection sessions, design reviews and structured discussions link practice to pedagogical theory. Assessment is formative and continuous, based on active participation, visible learning processes, and the development of a functional physical computing project demonstrating STEAM integration and classroom applicability.

Learning Objectives

By the end of the course, participants will be able to:

Understanding STEAM Frameworks & Pedagogical Foundations

• Analyse the conceptual evolution from STEM to STEAM and evaluate its implications for interdisciplinary teaching and learning.
• Critically examine constructivist, inquiry-based and design-thinking approaches as foundations for STEAM education.
• Interpret how creativity, aesthetics and artistic processes can enhance scientific understanding and computational reasoning.

Physical Computing, Electronics & Arduino Programming

• Demonstrate conceptual understanding of basic electronics, circuit design and physical computing principles.
• Apply programming structures, logic and control statements to develop functional Arduino applications.
• Integrate sensors, actuators and microcontroller components to design interactive systems, prototypes and digital artefacts.

Designing STEAM-Based Learning Experiences

• Develop inquiry-based and project-driven learning sequences that synthesise scientific, mathematical, artistic and technological dimensions.
• Facilitate student engagement through iterative making, collaborative problem-solving and authentic STEAM challenges.
• Critically evaluate IoT, robotics and physical computing tools for their pedagogical value, accessibility and relevance in school contexts.

Professional Practice, Reflection & Implementation

• Document design processes, testing cycles and prototypes using appropriate digital tools and collaborative platforms.
• Reflect on their own teaching beliefs and translate course insights into sustainable STEAM practices within their institutions.
• Formulate an implementation plan for integrating Arduino-based STEAM activities into diverse learning environments.

Preparation

After registration participants will receive pre-course questionnaire which will be used by the trainer to learn about participants' teaching backgrounds and to assess their exact needs. Before the beginning of the course a basic reading list will be suggested to participants to prepare for the training. Participants will also be asked to prepare a presentation about themselves, their professional context and their culture. The presentation will be presented on the first day of the course to facilitate networking opportunities. Participants will receive information about the country they are going to visit in order to prepare them for their cultural experience.

Follow up

After the course participants will be asked to share what they have learned with the rest of the staff in their schools. Further books and articles to deepen the topic and contacts with some other practitioners all over Europe and in the world will be suggested by the trainer. The methods shared and explored and the bibliography given will allow the participants to complete and improve their educational path.

Certificate

Certificate complies with the guidelines of the Erasmus+ programme and includes the topic, number of didactic hours, dates and location of the course. We can list the record

of learning outcomes on the Europass Mobility Document on request of participants. In case a participant requires a specific format of certificate we can accommodate that if requested at least one week before the start of the course. It is necessary to attend at least 80% of the hours in order to receive the certificate.

Accommodation

We do not directly offer accommodation and subsistence and participants are responsible for organizing it by themselves.

Paperwork

We also provide all the support with paperwork you might need for your Erasmus+ project documentation such as mobility agreement and registration letter.

Fee: 800 €

Cancelation policy

We have a flexible cancellation policy in force at the moment and you can cancel your registration up to 30 days before the course and receive a full refund. In case you don't cancel the registration more than 30 days before you will not receive any refunds, but you will be able to choose to attend any other confirmed course session later (within 6 months) without any additional costs. In case you are not able to travel, your school can send someone else to take instead of you and you can change the details of the participant any time before the start of the course at no additional cost.

TENTATIVE PROGRAMME (50 didactic hours - 5*45min per day) Monday to Friday	
Day 1	Welcome, STEAM Frameworks & Foundations
09.00 - 09.45	Introductions & Icebreakers
09.45 - 10.30	Course Overview & Learning Agreement
10.30 - 11.15	Understanding STEAM

11.15 - 11.30	Break
11.30 - 12.15	Pedagogical approaches in STEAM
12.15 - 13.00	STEAM competencies and curriculum alignment
Day 2	Introduction to Physical Computing & the Arduino Ecosystem
09.00 - 09.45	What is physical computing?
09.45 - 10.30	Overview of Arduino boards, microcontrollers, shields & common components
10.30 - 11.15	Understanding the Arduino IDE, online editors & classroom-friendly environments
11.15 - 11.30	Break
11.30 - 12.15	Basic electronics concepts
12.15 - 13.00	First programming steps
Day 3	Playing with LEDs
09.00 - 09.45	Expanding LED projects
09.45 - 10.30	Arrays, variables and basic logic to control more complex lighting behaviours
10.30 - 11.15	Creative STEAM applications of LEDs
11.15 - 11.30	Break
11.30 - 12.15	Designing an interactive LED artefact
12.15 - 13.00	Pedagogical applications and classroom adaptations
Day 4	Sensors, Actuators and IoT Applications
09.00 - 09.45	Introduction to common sensors
09.45 - 10.30	Reading sensor data via Serial Monitor
10.30 - 11.15	Actuators
11.15 - 11.30	Break
11.30 - 12.15	Mini-project: building a simple reactive system
12.15 - 13.00	Introduction to IoT concepts and a functional mini “weather station” project
Day 5	Digital Collaboration, Reflection, Showcase & Closing
09.00 - 09.45	Online tools for STEAM collaboration, eTwinning, ESEP

09.45 - 10.30	Preparing the final presentations and individual support
10.30 - 11.15	Final presentations and feedback
11.15 - 11.30	Break
11.30 - 12.15	Evaluation & Reflection
12.15 - 13.00	Validation of learning outcomes and certification
Day 6	The Sound and Light Project
09.00 - 09.45	Introduction to buzzers & piezo speakers; tones & frequencies
09.45 - 10.30	Combining light and sound – synchronisation & creative design
10.30 - 11.15	Coding melodies; using libraries; debugging complex scripts
11.15 - 11.30	Break
11.30 - 12.15	Applied STEAM: turning abstract concepts into interactive artefacts
12.15 - 13.00	Project work: designing a small sound-light interactive device
Day 7	Sensors & Actuators (Input–Process–Output)
09.00 - 09.45	Types of sensors
09.45 - 10.30	Reading sensor data
10.30 - 11.15	Actuators
11.15 - 11.30	Break
11.30 - 12.15	Building a simple sensing system
12.15 - 13.00	Classroom applications
Day 8	IoT Application – Building a Simple Weather Station
09.00 - 09.45	What is IoT?
09.45 - 10.30	Connecting temperature/humidity sensors; reading serial data
10.30 - 11.15	Displaying data
11.15 - 11.30	Break
11.30 - 12.15	Creating a simple weather monitoring system
12.15 - 13.00	Discussion: integrating data literacy & environmental education through IoT
Day 9	Building a Robotic Car

09.00 - 09.45	Robotics basics
09.45 - 10.30	Assembling a two-wheel robotic platform
10.30 - 11.15	Writing motion control scripts
11.15 - 11.30	Break
11.30 - 12.15	Adding sensors
12.15 - 13.00	Robotics challenges
Day 10	Digital Collaboration, Reflection, Showcase & Closing
09.00 - 09.45	Online tools for STEAM collaboration, eTwinning, ESEP
09.45 - 10.30	Preparing the final presentations and individual support
10.30 - 11.15	Final presentations and feedback
11.15 - 11.30	Break
11.30 - 12.15	Evaluation & Reflection
12.15 - 13.00	Validation of learning outcomes and certification

*This is only a tentative timetable. The exact hours or the course might differ and will be announced for each session 2 weeks before the start. However, there will always be a total of 5 didactic hours per day and all will be in line with the Erasmus+ quality standards. The trainer might slightly modify the content in response to the needs of the group.
**Cultural and social programmes will be organized in addition to the academic programme. The exact cultural and social programme depends on the location, season, weather, etc.