

LEARNING PROGRAMME

The STEAM Education Paradigm – Developing Physical Computing Applications with Arduino

5-DAY COURSE

25 learning hours | Course programme

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Introduction and Description

The course *"The STEAM Education Paradigm – Developing Physical Computing Applications with Arduino"* provides a theoretically robust and practice-intensive exploration of how integrated STEAM frameworks can advance teaching and learning in contemporary European school environments. Positioned within broader debates on digital transformation, inquiry-based instruction and competency-oriented curricula, the course conceptualises STEAM not as a discrete subject area but as a multidimensional pedagogical paradigm that fosters interdisciplinary reasoning, creative expression, technological fluency and reflective problem-solving.

Underpinned by constructivist, sociocultural and constructionist perspectives, the programme investigates how learners construct meaning through embodied manipulation of materials, collaborative experimentation and the iterative refinement of design artefacts. Participants critically examine how physical computing—particularly through the accessible, open-source Arduino platform—functions as a mediating tool that bridges abstract scientific concepts, mathematical modelling, computational logic and artistic ideation. This materially anchored form of inquiry enables teachers to facilitate learning that is simultaneously analytical, creative and personally meaningful.

Throughout the course, educators engage in a scaffolded progression of hands-on workshops that illuminate the educational potential of basic electronics, microcontroller programming, sensing technologies, actuators and introductory Internet of Things (IoT) systems. These activities allow participants to generate functional prototypes that exemplify fundamental principles of interactivity, data acquisition, environmental monitoring and digital–physical integration. The process supports an in-depth understanding of how learners can be guided to explore complex systems, build resilience through debugging, and cultivate precision and creativity through iterative prototyping.

Beyond the technical dimension, the course foregrounds the epistemological and pedagogical significance of blending artistic thinking with scientific and technological inquiry. Participants analyse how STEAM learning environments can promote inclusive participation, strengthen multimodal communication, support diverse learner identities and foster transversal competences essential for digital-age citizenship. Discussions also address broader ethical, accessibility and

sustainability considerations associated with educational technologies and IoT-enabled learning artefacts.

The programme further situates STEAM education within European frameworks promoting digital literacy, green competences, open schooling, collaborative knowledge production and innovative school practices. Through engagement with platforms such as eTwinning and the School Education Gateway/European School Education Platform, participants explore avenues for transnational collaboration, project dissemination and long-term institutional capacity-building.

By the end of the course, educators will have developed a refined understanding of STEAM as a transformative paradigm that extends beyond disciplinary integration. Combining research-informed pedagogical analysis with practical prototyping experience, they will be equipped to design, implement and critically evaluate STEAM learning experiences that align with contemporary curricular reforms, promote student agency, and harness the pedagogical power of physical computing to enrich school learning ecologies.

Methodology and Assessment

The course adopts an experiential, constructionist methodology centred on active making, experimentation and iterative design. Short theoretical inputs introduce key concepts, followed by hands-on workshops where participants build circuits, programme Arduino boards and develop functional prototypes. Collaborative problem-solving, peer feedback and guided debugging support deeper understanding and confidence. Digital tools are used to document processes and model classroom applications. Assessment is formative and continuous, based on participation, reflective engagement and the successful development of a small physical computing project demonstrating STEAM integration and pedagogical applicability.

Learning Objectives

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

Understanding STEAM Theory and Pedagogical Foundations

• Critically analyse the conceptual evolution and theoretical underpinnings of STEAM education, with attention to interdisciplinarity, creativity and inquiry-based learning.
• Evaluate how constructivist and design-oriented pedagogies support meaning-making, problem-solving and student agency in STEAM contexts.

• Interpret the role of artistic processes and multimodal representation in enhancing scientific and technological learning.

Developing Technical Competence in Arduino-Based Physical Computing

• Demonstrate understanding of fundamental electronic principles, circuit design and microcontroller operation.
• Apply core Arduino programming structures (digital/analog control, loops, conditionals) to design simple interactive systems.
• Integrate LEDs, sensors and actuators into functional prototypes and IoT-inspired applications (e.g., weather station).

Designing and Facilitating STEAM Learning Experiences

• Create inquiry-driven tasks and project-based learning sequences that synthesise scientific, mathematical, technological and artistic dimensions.
• Support learners through iterative prototyping, debugging, reflective dialogue and collaborative problem-solving.
• Assess the pedagogical value, accessibility and curricular relevance of physical computing tools within contemporary school environments.

Professional Reflection and Implementation

• Utilise digital tools (eTwinning, ESEP, shared documentation platforms) to facilitate collaborative student projects.
• Reflect critically on their own learning and translate insights into sustainable STEAM practices appropriate to their institutional context.
• Formulate strategies for embedding physical computing activities into diverse classroom settings while ensuring inclusivity and learner engagement.

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: 400 €

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 (25 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

*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.