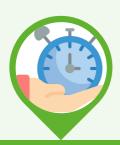# INTRODUCTION

DISCOVER THE LET'S STEAM PATHWAY

The main goal of the training materials you will find in this coursebook and across our e-learning platform is to raise the interest and understanding of all the teachers, independently from their background and technical expertise and appetence, regarding the creation of new content and activities using programming boards and coding practices in a creative way. The "Let's STEAM" coursebook has been created within a European project and this coursebook and activities refer to "Let's STEAM" as the training program and activities that will help teachers to understand and integrate programming boards in a creative learning way.

Algorithmics and coding practices can be highly relevant for approaching the challenges of our current society. Indeed, better knowledge of our surrounding environment is linked to the availability and comparison of datasets that are relevant to physical, environmental, chemical or ecosystemic concepts for instance and constituting them using sensors and programming is a powerful activity for the students, enabling them to concretely understand STEAM topics (*Science, Technology, Engineering, Arts & Mathematics*).

In order to benefit from all the possibilities offered by programmable boards and data collection, Let's STEAM training aims to use the learning of programming as a tool for teaching, in the service of creativity, and curiosity for science beyond being an isolated educational theme. Promoting an active and interdisciplinary pedagogy directed toward the students is therefore one of the fundamentals of our approach. Moreover, in the framework of the promotion of citizen science practices, Let's STEAM training wishes to offer the possibility to use these boards and sensors in order to engage students in a participative scientific approach, being then an effective way to motivate students toward scientific and technical learning.

In parallel, the Let's STEAM training also aims to address one of the major challenges related to the development of technical and technological activities in schools. Indeed, we wanted to offer our readers the opportunity to reflect on the crucial issues of ethics, inclusion and equity through additional concrete and practical resources in this handbook. Although of great importance, these issues are usually not or not adequately addressed in digital literacy training, even though it is a real challenge to stimulate students' motivation, interest and curiosity in science while considering all learners' needs.

These multiple technical and non-technical objectives have been translated by the authors of this manual, members of the Let's STEAM consortium, into a flexible and interdisciplinary methodology that is implemented throughout the content of our course. Understanding the needs of teachers in order to develop hands-on, motivating, inclusive and creative activity is, therefore, an essential aspect of the Let's STEAM approach. In concrete terms, this translates into a general and adaptable framework based on a pedagogical approach through experimentation, data collection and analysis, and questioning, illustrated by the authors and supported by practical resources.

Reflecting this approach, the Let's STEAM teacher training programme has been built on both a **theoretical approach** (**PART I**), but also **concrete tools, tutorials and models** (**PART II**) to deepen the knowledge and quickly put into practice the skills acquired here in the classroom. Each part takes up the three essential axes that constitute our approach, namely: *inquiry-based learning, programming as a tool for STEAM learning, and ethical and inclusion issues in techno creative activities*.

PART I - THEORY - GET FAMILIAR WITH THE LET'S STEAM CONCEPTS AND APPROACHES

The first part of the handbook is to discuss with readers/teachers the triptych of interconnected concepts on which the whole Let's STEAM approach is based. These concepts will be approached in a succinct and factual manner, keeping in mind the pillars of the training and including the following questions:

- How can we create **inquiry-based learning activities** that promote **meaningful and interdisciplinary** content for students in **technology-enhanced education**?
- How can we create **inclusive activities** to ensure the **motivation and interest** of all students and promote content that **goes beyond stereotypes**?
- How to **develop mastery of programming practices** both so that **teachers** feel more comfortable in launching **large-scale interdisciplinary projects** using programming as a tool, but also, in the service of **their students**, to better understand programming as an excellent way to **address societal challenges** in a more advanced way?

This part of the manual is therefore divided into three chapters:

The first chapter "*Deepening your knowledge and use of the inquiry-based approach*" focuses on understanding the steps involved in an inquiry pedagogical methodology in order to replicate it in technology-enhanced activities. This theoretical chapter will be complemented by a set of additional practical resources to develop your own teaching materials related to the implementation of programming-based activities in your classroom and to draw on examples provided in this handbook that address the phases of inquiry-based learning.

The second chapter "*Reflecting on inclusiveness and equity while conceiving a technology-enhanced activity*" discusses the basic concepts and definitions that are essential for developing more inclusive activities that can help to stimulate the interest and curiosity of your students, adapted to the contexts and educational needs of learners and schools. It will be complemented in the second part by concrete activities to stimulate everyone's thinking around this subject which can be complex to tackle.

Finally, the chapter "*Basics of programming - software and hardware*" is intended to introduce teachers/readers to the MakeCode editor and the STM32 board, which are used in the activity sheets found in this manual. It aims to familiarise learners with the programming learning platforms, and with the STM32 Discovery board, which has been chosen for its technical capabilities and its set of integrated sensors, allowing the development of complex experimental projects, stimulating students' interest and creativity. Once the knowledge is acquired, this chapter can be a good introduction for your own students to introduce them to the programming tools and associated features.

PART II - PRACTICAL APPLICATION - ACTIVITY SHEETS AND TEMPLATES

Once you are familiar with the three concepts that form the core of the Let's STEAM approach, it will be time to put all this knowledge into practice with the help of activity sheets on the one hand and outlines and examples on the other.

ACTIVITY SHEET. In this second part, you will find two sets of activity sheets that can be used for training purposes and directly implemented in your classroom:

- The first series "*Programming easily thanks to let's steam activity sheets*" introduces you to the programming and use of sensors and programmable boards. Through 15 different projects, you will approach various functions and components of the electronic board (and in particular of the sensors) in order to discover their potential from concrete and specific practices (such as breadboarding, making an LED blink, creating a readable thermometer with the embedded sensor and a basic screen).

- The second set of activity sheets "*Inclusion and equity: resources for students & trainers*" allows you to work on turning your technology activity into an inclusive project. This is made possible through a number of reflective activities that can be carried out either on your own using the templates provided, or with the help of your Let's STEAM ambassadors (your local contact is given at the end of this manual), or with your colleagues and/or pupils.

TEMPLATE AND EXAMPLES. Eventually, all the knowledge and activity sheets are collected in a reproducible template "***Replicate IBL in your classroom - Guidelines & Template***" allowing you to build your own learning pathway, using Let's STEAM resources. It is strongly recommended that you use and revisit all the resources presented in this manual on a regular basis in order to achieve a good balance between your societal approach and the technical skills you bring to your students on programming.

Feel free to re-use all or part of this manual, whether it is the theoretical concepts or the activity sheets and templates, in your classroom by using the activities as inspiration, copying the activity sheets for direct use by your students and creating your own lesson plan! Our content has been developed entirely under a Creative Commons license. This license gives you the right to use this content for your own materials!

By following the proposed pathway, you will be introduced to programming in a progressive way throughout the Let's STEAM course and will carry out activities of increasing difficulty. You will have the opportunity to apply the technical knowledge acquired through the programming activity sheets to the design of educational material by following the development and content creation steps based on the experimentation phases. This will make your activities more meaningful and inclusive for all your students!

Let's your Let's STEAM adventure begin!