**AutoSTEM** is an Erasmus+ project that is using automata to promote motivation for STEM education and the development of transversal skills in children. It has produced a set of resources to be used preferably by early childhood education, care workers and primary school teachers.

Automata are fascinating mechanical toys, small sculptures of Kinetic Art. Automata consist of two main parts, a toy with a narrative, and a mechanism that makes the toy move. They can be seen as "mechanical storytelling objects" or as a combination of engineering, cultural awareness and artistic expression.

This guide is an abridged version of a document in which you can find the whole conceptual framework, pedagogical resources and examples of how the AutoSTEM Project has been implemented in schools in Europe. It is intended to be a "Pedagogical Guide", a manual for teachers and educators on how to use the resources that have been created within the project, from a pedagogical aspect.
This guide is divided into five chapters:

- Chapter 1, the **Toolbox**, integrates several documents that can support practice.
- Chapter 2, **Automata**, includes the Pedagogical Guidelines & Construction Instructions (PG & Ci) of the automata.
- Chapter 3, **Events & Workshops**, presents some of the activities developed.
- Chapter 4 refers to the **Case Studies**, based on the research on the activities carried out within the project.
- Chapter 5 presents the **Online Course** available on the project website.

The **AutoSTEM Guidebook**, in this abbreviated version, directs access to all this information, and is organized with QR codes directed to all the important documents, videos or pages. The guide is available in the five project languages.

**SCAN THIS QR CODE TO GET ACESS TO THE AUTOSTEM WEBSITE**
CONTENTS

01 Toolbox

02 Automata

03 Events & Workshops

04 Case Studies

05 Online Course
In the **Toolbox** are the resources produced by the AutoSTEM project that will help in using the activities.
The Step by Step Teacher Guide is a document that compiles information about automata and the STEM subjects, the theoretical framework and pedagogical concept and the STEM content that you can teach with our automata. Some key concepts for building the automata are also presented in this document.

This guide should serve as a basis for the teacher's practice in using the activities of the AutoSTEM project.
On the page, ‘Pedagogical Guidelines and Construction Instructions’ you can find a list of all the automata designed and developed by the AutoSTEM project, however, these will be also presented individually below.
On the Scenarios & Narratives page you can find suggestions of scenarios or narratives to develop when using the AutoSTEM project activities. These can provide better uses of all the features of the different automata when teaching STEM subjects.
Within the **Resources for Planning & Reflection** you can find materials that support the planning, recording and reflection on the activities developed with children within the project.

In addition to the full version, these documents can also be referred to separately depending on the template that is used.
01 TOOLBOX

Resources for Reporting & Evaluating

- FULL DOCUMENT OF TEMPLATES
- INDIVIDUAL TEMPLATES
- PLANNING TEMPLATE
- LOGBOOK TEMPLATE
POST QUESTIONNAIRE (6/7 YEARS) TEMPLATE

PARENTAL PERMISSION

OBSERVATION GUIDE

REPORTING TEMPLATE
02

Automata

In Automata every Pedagogical Guideline & Construction Instruction (PG & CI) for each automata is presented with video tutorials.
The **JellyBird** is a moving toy made of paper and cardboard that can move its wings like a bird.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Mechanisms
- Mathematics
- Biology

Scan this QR code to get access to the JellyBird PG & CI or video:

- Pedagogical Guidelines & Construction Instructions
- Tutorial
The **Talking Elephant** is a simple automata made from a cardboard box with the face of an elephant on the front and a lever at the back. Making the lever move makes the elephant look like it is talking.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Mechanisms
- Biology
- Mathematics
- Physics

---

**SCAN THIS QR CODE TO GET ACCESS TO THE TALKING ELEPHANT PG & CI OR VIDEO**

- Pedagogical Guidelines & Construction Instructions
- Tutorial
The **Dancing Doll** is a paper doll that fits on the top of a box and turns around when a hand crank is activated, using a mechanism inside the box.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Mechanisms
- Biology
- Mathematics
- Physics

**SCAN THIS QR CODE TO GET ACCESS TO THE DANCING DOLL PG & CI OR VIDEO**
The **Balloon Car** is a moving car made of cardboard, straws and a balloon, that will move on its own when the balloon is inflated.

**Target Group**
- 5 – 7 years

**Subjects covered**
- Mathematics
- Physics
- Mechanisms
The **Balloon Boat & Amphicar** is a boat and a car at the same time made from a standard milk or juice carton that will move on its own when the balloon is inflated.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Physics
- Mechanisms
- Energy transfers

SCAN THIS QR CODE TO GET ACCESS TO THE BALLOON BOAT & AMPHICAR PG & CI OR VIDEO

Pedagogical Guidelines & Construction Instructions

Tutorial
The Snapping Crocodile is a cardboard moving toy which makes use of a scissor's mechanism. It has the face of a crocodile. Other elements can be added that will move when the mechanism is manually activated.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Mathematics
- Engineering
- Mechanisms

SCAN THIS QR CODE TO GET ACCESS TO THE SNAPPING CROCODILE PAGE OR VIDEO

Pedagogical Guidelines & Construction Instructions

Tutorial
The **Catapult** is a simple toy that has the capacity to shoot small, lightweight projectiles a short distance. This toy can be used in a number of different mathematical games.

**Target Group**
- 4 – 8 years

**Subjects covered**
- Physics
- Mechanisms
- Mathematics

SCAN THIS QR CODE TO GET ACCESS TO THE CATAPULT PAGE OR VIDEO

---

Pedagogical Guidelines & Construction Instructions

Tutorial
The Acrobat is a moving toy that make acrobatic movements when the linkages are complete, and a rotation movement is made manually.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Physics
- Mechanisms
- Biology

**SCAN THIS QR CODE TO GET ACCESS TO THE ACROBAT PG & CI OR VIDEO**

Pedagogical Guidelines & Construction Instructions  Tutorial
The Wind Turbine is made with paper cups or paper sheets that turns around when acted on by the wind. It can be used to move other objects or devices.

**Target Group**

- 4 – 7 years

**Subjects covered**

- Physics
- Mechanisms
- Mathematics
- Biology
- Engineering

SCAN THIS QR CODE TO GET ACCESS TO THE WIND TURBINE PG & CI OR VIDEO

Pedagogical Guidelines & Construction Instructions

Tutorial
The **Colour Spinning Disk** is a rotating disk whose surface is divided into different colours that appear to change when the rotation movement is triggered, manually.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Mathematics
- Physics
- Mechanisms

SCAN THIS QR CODE TO GET ACCESS TO THE COLOUR SPINNING DISK PG & CI OR VIDEO

Pedagogical Guidelines & Construction Instructions

Tutorial
The Eco Car 1 is a simple car made from wood sticks, straws and bottle tops that can move forward when the mechanism is activated manually.

Target Group
• 4 – 7 years

Subjects covered
• Physics
• Mechanisms
• Mathematics

SCAN THIS QR CODE TO GET ACCESS TO THE ECO CAR 1 PG & CI OR VIDEO

Pedagogical Guidelines & Construction Instructions
Tutorial
The **Eco Car 2** is also a simple car that can move forward when a different mechanism is activated manually.

**Target Group**
- 5 – 8 years

**Subjects covered**
- Mathematics
- Physics
- Engineering
- Mechanisms

[SCAN THIS QR CODE TO GET ACCESS TO THE ECO CAR 2 PG & CI OR VIDEO]

Pedagogical Guidelines & Construction Instructions

Tutorial
The Elevator is a small house made from a milk or juice carton that contains a winch that is used to lift and lower an elevator. This toy’s mechanism is activated manually and has a rotation movement.

Target Group

- 4 – 7 years

Subjects covered

- Engineering
- Mechanisms
- Mathematics
The **Drawbridge** is a toy bridge that can be raised to permit passage of a ship under, or to protect the entrance of a castle.

**Target Group**
- 5 – 8 years

**Subjects covered**
- Physics
- Mechanisms
- Mathematics
- Engineering
The **Returning Tin Can** is a tin can with a cylinder shape. A rubber band twisted inside allows it to roll across surfaces but it will return to its point of origin, as soon as its stops.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Physics
- Engineering
- Mathematics

SCAN THIS QR CODE TO GET ACCESS TO THE RETURNING TIN CAN PG & CI OR VIDEO

Pedagogical Guidelines & Construction Instructions

Tutorial
Moving Shapes & Two Faces

The **Moving Shapes, Two faces** is a toy made with cardboard that uses a linkage mechanism so that it can move into different geometric shapes.

**Target Group**
- 4 – 7 years

**Subjects covered**
- Physics
- Mechanisms
- Engineering
- Mathematics

**SCAN THIS QR CODE TO GET ACCESS TO THE MOVING SHAPES & TWO FACES PG & CI OR VIDEO**

- Pedagogical Guidelines & Construction Instructions
- Tutorial
The Grabbing Hand is a mechanical hand toy built from paper cups, straws and threads. This toy will move when the threads are pulled.

Target Group
• 4 – 7 years

Subjects covered
• Mathematics
• Biology
• Mechanisms

SCAN THIS QR CODE TO GET ACCESS TO THE MOVING SHAPES & TWO FACES PG & CI OR VIDEO

Pedagogical Guidelines & Construction Instructions
Tutorial
A more elaborate version of the Grabbing Hand was developed, the **Grabbing Hand - Advanced Edition**.
In this version, each of the wires that are pulled to cause the movement in the hand, is connected to one of the hand's fingers, this results in an even more realistic hand movement.
AutoSTEM across Europe
In Events & Workshops the activities developed by the project are presented.
On the Events & Workshops page, are reports of several activities already used in the AutoSTEM project.

You can find a report on the Erasmus Day 2020 that was celebrated by the project in Portugal, reports of several workshops with teachers and students, a report on the visit of the Portuguese National Agency and also the participation of the project in a number of conferences.
ERASMUS DAY 2020

MULTIPLIER EVENTS

WORKSHOPS FOR
TEACHERS & EDUCATORS
CHILDREN

VISIT OF PORTUGUESE NATIONAL AGENCY

CONFERENCES
In **Case Studies** are the studies and research developed by the project using the resources that have been developed within it’s activities.
The **Case Studies** report some of the findings from workshops and teacher training carried out by the project partners in their countries.

There are twelve case studies included in three broad areas:

1. **Case Studies with a target audience of learners aged 4-12**
2. **Case Studies with a target audience of teachers**
3. **Case Studies with a target audience of SEN students**
Including an AutoSTEM activity in an annual classroom project ‘The garden’

The Travelling (Jelly)Bird

The Ulysses’ boat

When two hands are not enough: spontaneous cooperation between children when constructing automata
04 CASE STUDIES
CASE STUDIES WITH A TARGET AUDIENCE OF LEARNERS AGED 4-12

- Children’s engagement and learning in a moving toys workshops in a primary school
- Integration of the AutoSTEM project in the curriculum. Making an Acrobat
- Development of skills for problem detection, choice of work strategy, decision making, activity planning
- From guided play to creativity: metamorphoses and stories of a bird
- Using Automata in an after-school Science Club
CASE STUDIES WITH A TARGET AUDIENCE OF TEACHERS

Using self-made automata to teach STEM in early childhood teacher education

CASE STUDIES WITH A TARGET AUDIENCE OF SEN STUDENTS

Outcomes of Automata for STEM activities with cognitive and physically impaired people

Hearing and touch for seeing: Instructions to promote mental representation of geometric shapes in visual impaired people when constructing a moving toy
The Online Course is designed for teachers and educators that want to learn to use the project. It is a full, modular course and is available on the AutoSTEM website.
The **Online Course** is designed as a modular course that teachers and educators working with preschool, kindergarten, and young primary age children can use to understand the project better and learn how to use the project’s resources autonomously.

The course is organised into 5 modules:
AutoSTEM across Europe
The AutoSTEM team would like to thank all the teachers and children involved in the workshops, training and case studies, and wishes all those interested in STEM subjects meaningful and playful learning when using the AutoSTEM ideas and project materials.