



The ERGO project revitalises robotics education with online and simulation tools, aiming to enable secondary school teachers to teach robotics online within an inclusive STEAM framework. It focuses on sparking students' interest in Robotics & STEAM, particularly emphasizing girls' empowerment, and strengthens interdisciplinary collaboration among educators and experts to create OERs. ERGO is dedicated to making robotics accessible to all students, regardless of physical lab access. ERGO starts with the pedagogical and technical review for setting the groundwork of the project. The design of the ERGO eCourse and the participatory design of the elearning content for teachers and OERs for students, follow. A key activity is the delivery of the online teacher training along with the realization of live webinars. Finally, the implementation of the pilot activities with students allows the ERGO team to evaluate the ERGO learning intervention and share the results broadly

This document provides teachers with a manageable set of tools and simulation technologies for implementing online robotics and coding activities.

Name	Company/authors	Link
AppInventor	MIT	https://appinventor.mit.edu/
BlocksCAD		https://www.blockscad3d.com/

CoderZ		https://gocoderz.com/
CodeSpace simulation		https://firialabs.com/pages/hour-of-codespace-sim
Coppelia Sim	Coppelia	https://www.coppeliarobotics.com/
Cyberbotics		https://cyberbotics.com/

EV3DevSim		https://www.aposteriori.com.sg/Ev3devSim/index.html
FTCsim	FIRST	https://ftcsim.org/
Gearsbot		https://gears.aposteriori.com.sg/
Geogebra		https://www.geogebra.org/search/robot
iRobot education	iRobot	https://edu.root.samlabs.com/

MakeCODE

Microsoft

<https://makecode.microbit.org/>

mBlock

<https://mblock.cc/>

Minecraft education

Minecraft

<https://education.minecraft.net/it-it/challenges/mini-agent-mission>

Miranda software

<https://www.miranda.software/>

Open Roberta Lab

Fraunhofer IAIS

<https://lab.open-roberta.org/>

OZOBot Challenges

Ozobot

<https://ozobot.com/create/challenges/>

PictoBLOX

STEMpedia

<https://pictoblox.ai/>

Rocksi

<https://rocksi.net/>

Sam Labs

Sam Labs

<https://root.samlabs.com/#/explore>

Scratch

MIT

<https://scratch.mit.edu/>

Tinkercad

Autodesk

<https://www.tinkercad.com/>

VEX

<https://vr.vex.com/>

Virtual robotics toolkit	Cogmation	https://www.virtualroboticstoolkit.com/
Vitta science		https://en.vittascience.com/
Webots	Cyberbotics	https://cyberbotics.com/

Description	Suitable for secondary	Free?	Level (1 to 5, 1:preliminary- 5: advanced)	Can a project be based on this?
programming environment that allows everyone – even children – to build fully functional apps for iPhones, Android phones, and Android/iOS tablets. Those new to MIT App Inventor can have a simple app up and running in less than 30 minutes. What's more, our blocks-based tool facilitates the creation of complex, high-impact apps in significantly less time than traditional programming environments. The MIT App Inventor project seeks to democratize software development by empowering all people, especially young people, to move from technology consumption to technology creation.	yes	yes	1	yes
BlocksCAD is a cloud-based, drag-and-drop 3D modeling tool designed for education, allowing users to create complex 3D models using code-based blocks similar to Scratch. It is built for grades 3-12 to teach math and computer science concepts, enabling users to render, transform, and export STL files for 3D printing				

coding platform that combines STEM, computer science, and critical life skills				
Begin your journey into Python programming with our powerful 3D Coppeliasim is used for fast algorithm development factory automation				
Webots is an open source and multi-platform desktop application used to	yes	yes	4	yes
	yes	yes	4	

DevSim enables students to write Python programs for a virtual EV3 robot. The same programs can be used on a physical EV3 robot running ev3dev.

An FTC simulator, specifically FIRST Tech Challenge (FTC) SIM, is a virtual Gears (aka GearsBot) is a 3D Robotics simulator. It supports programming in GeoGebra is used in robotic education as a dynamic, free simulation tool to visualize kinematics, simulate 2D/3D robot arms, and teach coding concepts. It allows students to build virtual robots, manipulate joint angles, and explore rotational mechanics (moments) in real-time, bridging theoretical mathematics with practical engineering. Featuring 3 learning levels in a visual block-based coding environment. the

yes

yes

3 yes

Microsoft MakeCode for micro:bit is a free, web-based code editor and simulator that allows users to program the BBC micro:bit pocket-sized computer using drag-and-drop blocks or JavaScript/Python. It features a built-in virtual simulator for testing code immediately, making it ideal for	yes	yes	1 yes
Makeblock describes itself as a non-profit of STFAM and focuses on	yes	yes	1 yes
Students design their own AI agents that can: Sense the world around them (What's happening?) Think about what to do (What's the best action?) Act to help solve problems (Let's do it!) Whether it's an agent that helps farmers during droughts, protects villages at night, or keeps our environment clean, students learn how AI works by building solutions that matter.			

Create simulations of existing or purely imaginary robots in a few clicks. Share your creations with your friends. Create challenges for your students. Here are some of the activities offered by miranda.

Why simulating STEM robots?

The interest of simulation is not to replace real STEM robots but rather to enrich activities with the possibility of simulating more robots and also to create challenges.

This last point is very important because it allows students to train alone, to face the succession of failures and successes by programming robots with Scratch or Python.

Motivation is a key point in learning, knowing how to program an STEM robot is good, being able to carry out a specific

no (19.90 eur for single user licence)

Open Roberta Lab is a free, cloud-based, open-source programming environment designed for education. It allows users to code robots and microcontrollers using the graphical, block-based language NEPO® in a web browser. The platform includes a simulation feature and supports various robots, including LEGO Mindstorms EV3, NXT, and Arduino-based bots.

yes

yes

2 yes

An Ozobot challenge is a hands-on STEM activity where you program a small robot (the Ozobot Bit or Evo) to complete a specific task or solve a problem. These challenges range from simple line-following tasks for beginners to complex, multi-bot logic puzzles for advanced users.

yes

yes

2 yes

PictoBlox is an educational, block-based coding software developed by STEMPedia designed for beginners, particularly kids and teens aged 7+, to learn programming, AI, machine learning, and robotics. Based on Scratch 3.0, it allows users to create interactive games, animations, and program hardware, including robots like Quarky and boards such as Arduino and micro:bit.

yes

yes

1 yes

Rocksi was created to make robots more accessible. Whether you're a teacher, a student, a specialist worker or just interested, Rocksi enables you to understand and share the very core concepts of robotics.

SAM Labs provides comprehensive STEAM and coding solutions for K-8 classrooms, combining wireless electronic blocks with intuitive software (SAM Studio) to teach coding, computational thinking, and engineering. It offers curriculum-aligned, hands-on learning experiences designed to help educators integrate technology easily

yes

yes

1 yes

Scratch is a free, block-based visual programming language and online community designed primarily for ages 8 to 16 to create interactive games, stories, and animations. Developed by the MIT Media Lab, it uses drag-and-drop, color-coded blocks to teach fundamental coding concepts without requiring complex syntax.

yes

yes

1 yes

Tinkercad is a free, web-based 3D modeling, electronics, and coding

yes

yes

1 yes

vr.vex is an environment for programming and simulating a robot without the need of the physical robot

yes

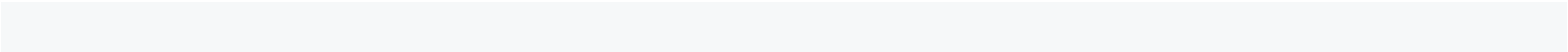
yes

3 yes

Cogmation Robotics develops simulation software that enables users to design & control robotics systems. This technology has been proven to engage more STEM (Science Technology Engineering Math) students with their	yes	no	3 yes
Vittascience is a comprehensive educational software platform designed	yes	yes	1
Webots is a free, open-source, multi-platform 3D robot simulator developed	yes	yes	3 y

Link to project(s) if available	Inclusive/accessibility	Language	Mechanics	Electronics	Programming	Science	Technology
	yes	English	no	no	yes	yes	yes

	yes	English	yes	yes	yes	yes	yes
	yes	English	yes	yes	yes	yes	yes



yes	English	yes	yes	yes	yes	yes
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yes

English

no

no

yes

yes

yes

yes

English

yes

yes

yes

yes

yes

yes

Multiple

no

no

yes

yes

yes

yes

English

no

no

yes

yes

yes

yes

English

no

no

yes

yes

yes

yes	English	no	no	yes	yes	yes
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yes	Multiple	no	no	yes	yes	yes
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https://www.tinkercad.com/blog/2	Multiple	yes	yes	yes	yes	yes
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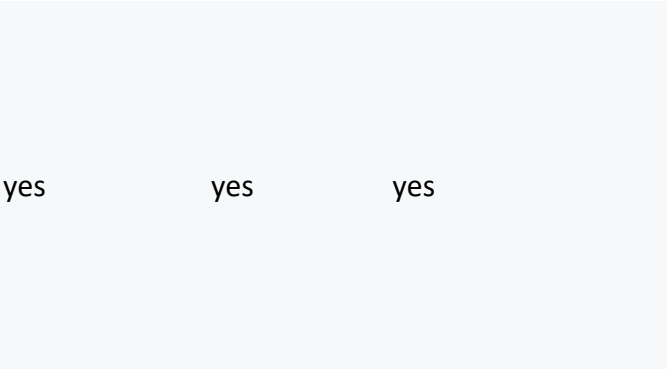
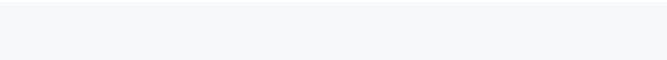
yes	Multiple	yes	yes	yes	yes	yes
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yes	English	yes	yes	yes	yes	yes
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yes	English	yes	yes
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Engineering	Art	Mathematics
yes	yes	yes

yes	yes	yes
yes	yes	yes



yes

yes

yes

yes

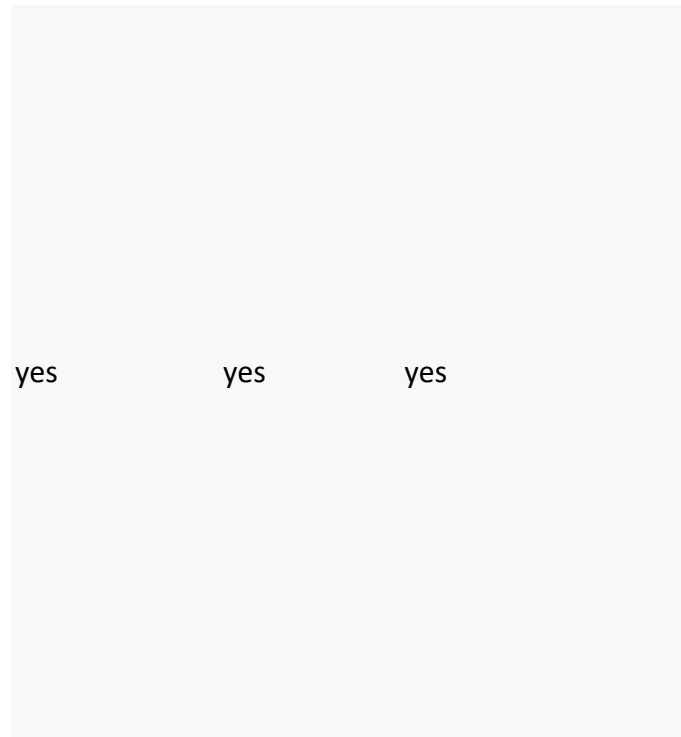
yes

yes

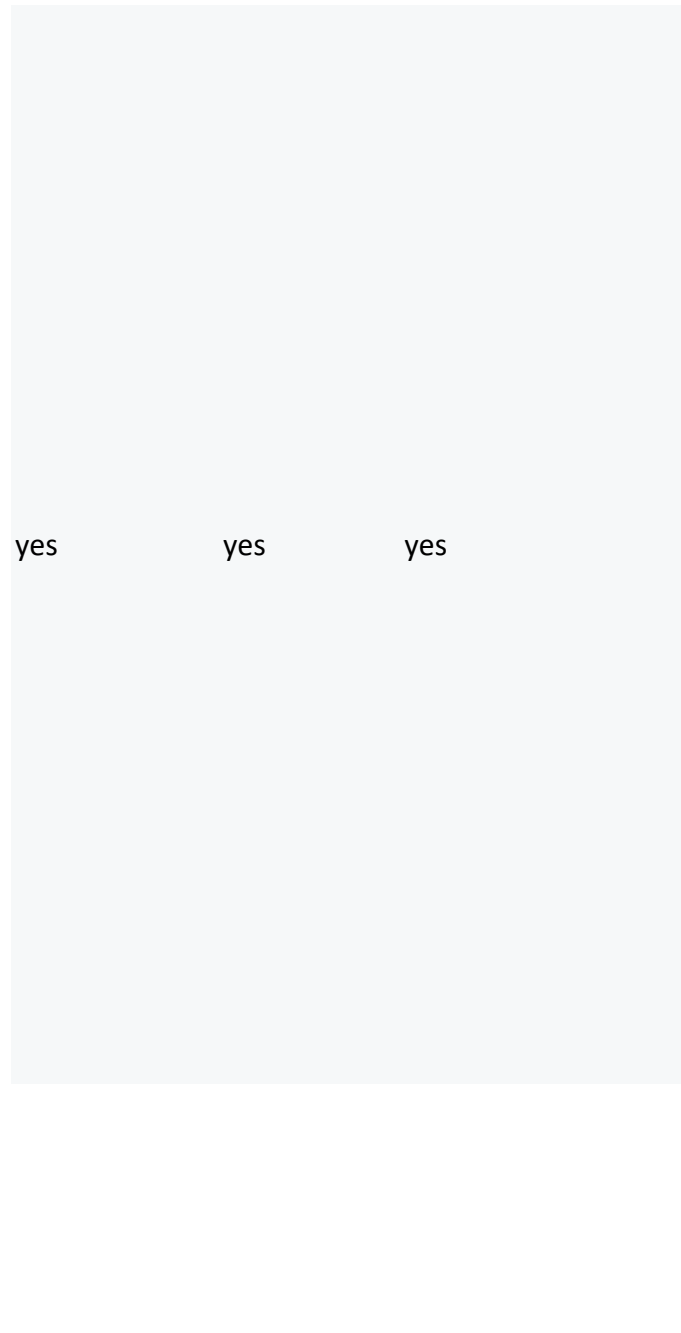
yes

yes

yes



yes yes yes



yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

yes

no

yes

yes

yes

yes

yes

yes

name	Company/authors	Link
Carboard robots	Maciej Wojnicki	https://cardboard.lofirobot.com/
Carnegie Mellon Robotics Academy	Carnegie Mellon	https://www.cmu.edu/roboticsacademy/roboticscurriculum/Lego%20Curriculum/spike-virtual.html
Explore Robots	IEEE	https://robotsguide.com/robots

Fusion360	Autodesk	https://www.autodesk.com/pro
Grab CAD library	Stratasys	https://grabcad.com/library
Instructables	Autodesk	https://www.instructables.com/
Lego education	Lego	https://education.lego.com/it-it/
Matlab	MathWorks	https://www.mathworks.com/academia/students.html

Poppy

Poppy project

<https://www.poppy-project.org/en/>

ROS (Robot Operating System)

[ROS.org](https://www.ros.org/)

<https://www.ros.org/>

WRO education

WRO

<https://wro->

NASA robots

NASA

<https://spaceplace.nasa.gov/spa>

Description	Suitable for	Free?	Level	Inclusive	Language	Mechanics
CARDBOARD ROBOTS is a set of free robot plans, apps and building techniques easy to replicate worldwide with recycled materials and basic electronic components.	yes	yes		1 yes	English	yes
Carnegie Mellon Robotics Academy studies how educators can use robots to teach Computer Science, Science, Technology, Engineering, and Mathematics (CS-STEM). Our mission is to use the educational affordances of robotics to create CS-STEM opportunities for all learners. We fulfill our mission by developing research-based solutions that are						
An extensive library of existing robots	yes	yes		1 yes	English	yes

All-in-one cloud platform for product GrabCAD, a Stratasys solution, is a major online community and software platform for engineers and designers, offering over 6 million free CAD files and tutorials. It provides tools for additive manufacturing, including GrabCAD Print (for 3D printing preparation), GrabCAD Shop (workflow management), and GrabCAD SDKs for enterprise connectivity.	yes	no, but free	4 yes	Multiple	yes
Instructables is a popular, Autodesk-owned community-driven website dedicated to DIY projects, sharing, and step-by-step collaboration. It hosts hundreds of thousands of user-generated projects.	yes	yes	3 no	English	yes
LEGO® Education is part of The LEGO Group, a brand that's been committed to fostering brighter futures for children for nearly a century. The platform combines educators' expertise, the LEGO® brick, and learning through play with a deep understanding of educational standards.	yes	no	1 yes	Multiple	yes
MathWorks is the leading developer of mathematical computing software for engineers and scientists	yes	no	4 yes	yes	yes

Poppy is an interdisciplinary community of beginners and experts, scientists, educators, developers and artists, who all share a vision: robots are powerful tools to learn and be creative.

yes

yes

3 yes

English

yes

The Robot Operating System (ROS) is
WRO Learn is a free online learning

yes

yes

4 yes

English

no

An article on NASA robots

yes

Electronics	Programming	Science	Technology	Engineering	Art	Mathematics
yes	yes	yes	yes	yes	yes	no
yes	yes	yes	yes	yes	yes	no

no	no	no	yes	yes	yes	no
yes	yes	yes	yes	yes	yes	yes
yes	yes	yes	yes	yes	yes	yes
yes	yes	yes	yes	yes	yes	yes
yes	yes	yes	yes	yes	yes	yes

yes

yes

yes

yes

yes

yes

no

no

yes

yes

yes

yes

no

no

Title	Instructors
Begin Robotics	R. Miller, W. Harwin

Building Robots with TJBot

J. Bisson, L. Frantzell

Coding a scuola con software libero (Coding at school with free software)	A. Formiconi
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Die digitale Welt mit dem Thymio Roboter entdecken (Discover the	D. Assaf, J. Dehler Zufferey, M. Garzi, C. Gia
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Diseña, fabrica y programa tu propio robot (Design, manufacture a	L. Armesto Angel
Fun with Beginner LEGO MindStorms EV3 Robotics	Y. Lu, Y. Chen

Introducción a la robótica e industria 4.0 (Introduction to robotics & industry 4.0)	L. A. Munos Ubando, D. A. Sansores Peraza
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Le robot Thymio comme outil de découverte des sciences du numérique	F. Mondada, D. Roy, E. Page, M. Chevalier
Robótica (Robotics)	E. Ruiz Velasco
Basics of Robotics	Siemens Digital Industries Software

Drones for environmental monitoring	David W. Johnston
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Platform	Link	Language
FutureLearn	https://www.futurelearn.com/courses/begin-robotics	English

<u>cognitiveclass.ai</u>	https://cognitiveclass.ai/courses/build-robots-with-tjbot	English
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edX	https://www.edx.org/course/coding-a-scuola-con-software-libero	Italian
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edX

<https://www.edx.org/course/die-digitale-welt-mit-dem-thymio-rol>

German

edX	https://www.edx.org/course/disena-fabrica-y-programa-tu	Spanish
Udemy	https://www.udemy.com/course/fun-with-beginner-lego-mindstorms	English

edX

<https://www.edx.org/course/introduccion-a-la-robotica-y-sistemas>

Spanish

edX	https://www.edx.org/course/le-robot-thymio-comme-outil-de-dec	French
Coursera	https://www.coursera.org/learn/robotica-inicial	Spanish
Coursera	https://www.coursera.org/learn/siemens-robotics-course	English

Coursera	https://www.coursera.org/learn/drones-for-environmental-science
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Free	Level	Main topics
no, but free limited access is available	1	Course main objectives are -Reflect on the wide variety of robots and their applications. -Explain how a robot moves, senses and responds to its environment using motors, sensors and actuators. -Demonstrate the various ways robots are controlled by humans through automation, haptic technologies and virtual reality. -Compare robot behaviour, cooperation and learning with that of living systems. -Practise the skills developed on the course through simulations that allow you to experiment, explore and test your knowledge.

yes		This course is for all those do-it-yourself Node.js or Node-RED programmers who want to learn IoT basics. You can purchase the TJBot if you don't already have one or run it in a simulator, so no purchase necessary! 3 You'll use artificial intelligence services (Watson) to program the robot to recognize objects and color, translate speech to text, recognize and translate languages, and analyze emotional tones in text. This robot with the help of Watson services can do it all...almost.
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yes		in this course, the students will: • learn to use Libero software and the ethics involved in the educational context; • master the fundamental programming phases: cycles, procedures, variables, conditional expressions and recursions; • create activities in STEAM (Science, Technology, Engineering, Arts and Mathematics) contexts for several age levels by putting the learning process in a vertical perspective; • implement Seymour Papert's "body-syntonic" approach for the acquisition of the basic geometric concepts; • prioritize learning strategies based on personal initiative and discovery. In this course, the students will: • learn to use Libero software and the ethics involved in the educational context; • master the fundamental programming phases: cycles, procedures, variables, conditional expressions and recursions; • create activities in STEAM (Science, Technology, Engineering, Arts and Mathematics) contexts for several age
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yes		This course is aimed at anyone who wants to master the Thymio robot, but is primarily intended for primary and secondary school teachers who want to discover this tool and use it in their 3 lessons. Through this course, you will acquire the fundamentals of computer science and robotics. Tailored tasks are suggested for each topic, and learning pathways for classroom presentation are provided.
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yes		in this course, you will learn to design, build, and program your own robot (DYOR: Do Your Own Robot) using Arduino. This methodology has been implemented for years in robotics courses at the Polytechnic University of Valencia. It is primarily aimed at educators in the fields of Technology and Computer Science, but is also suitable for anyone wanting to get started in the Maker movement. The ultimate goal of the course is for you to enjoy learning throughout the entire process of designing, building, and assembling the robot with diverse, varied, and multidisciplinary activities. Therefore, we have prepared all the necessary content that will allow you to build a fun, customizable, and low-cost robot from scratch, which you can then adapt to your needs. As a guideline, the cost of the materials to build the robot is around €65, which will be the responsibility of the student and can be purchased freely wherever you prefer.
yes		Learning by Doing - Lego EV3 Robotics for the absolute beginner, build small robots and program them using EV3-G.

yes	4	Robots have profoundly transformed the social environment, industry, and the way products and services are delivered. Robots no longer need to be made entirely of mechanical components to automate tasks. A new generation of robots (bots) has enabled the automation of more abstract tasks related to customer service, data analysis, and communication. Throughout the five modules of this course, you will understand the fundamental principles of robotics. You will apply programming techniques for configuring and manipulating physical robots. You will create bots for data and sentiment analysis. Finally, you will be able to identify the impact of robotics on Industry 4.0.
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yes		This course is for anyone who wants to master the Thymio robot, but it was primarily designed for primary and secondary school teachers eager to discover this tool and use it in the classroom. It provides the fundamentals of computer science and robotics by offering tailored problem-solving scenarios and offering pedagogical guidance for classroom activities. It aligns with the new curricula for introducing digital science in schools in both France and Switzerland and was developed jointly by Inria and EPFL.
yes		Build and control a mobile robot from your cell phone. Apply basic principles of mechanics, electronics, and programming to simple projects.
yes		Robotics Basic is an introductory course that provides a structured, hands-on overview of industrial robotics. Over 13 compact modules, learners explore the mechanical, electrical, and digital components that make up modern robotic systems.

yes		Describe how a variety of drones can accomplish important missions in environmental science. 4 Explain the importance of key best practices in drone research, including legal and ethical considerations. Discover relevant drone career paths for environmental science.
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Title	Instructors	Online Since	Link
Introduction to Robotics (CS223A)	O. Khatib	2008	https://see.stanford.edu/course/cs223a (accessed: 12-2020)
Lecture Series on Robotics	C. Amarnath	2008	https://www.youtube.com/watch?v=DaWMvEY3Qgc&list=PL2A735F42FA18D5D
Robotics 1	A. De Luca	2014	https://www.youtube.com/watch?v=pitZv3PuVMw&list=PLAQopGWIlcyaqDBW1
Programming for Robotics (ROS)	P. Fankhauser, I	2017	https://www.youtube.com/watch?v=0BxVPCInS3M&list=PLE-BQwvVGf8HOvwX
Modern Robotics: Mechanics, Planning, and C	K. Lynch, F. Parl	2017	https://www.youtube.com/watch?v=jVu-Hijns70&list=PLggLP4f-rq02vX0OQQ5v
The Art of Grasping and Manipulation in Robot	D. Prattichizzo, I	2018	https://www.youtube.com/watch?v=nX2SPrambc0&list=PLfYZRHo5ca5aCioi0Fc
Robotics 2	A. De Luca	2020	https://www.youtube.com/watch?v=HYnE7YgJAXs&list=PLAQopGWIlcya6LnIF8
Evolutionary Robotics	J. Bongard	2020	https://www.youtube.com/watch?v=CmiJIKxtEOE&list=PLAuiGdPEdw0inIKisM

[D \(accessed: 12-2020\)](#)

[zSKx7IHfVcOmWSWt \(accessed: 12-2020\)](#)

[PqtDfWoxd4Cc6ghiP \(accessed: 12-2020\)](#)

[rCxbJrzamYDfx \(accessed: 12-2020\)](#)

[zR-ltKhWtmjHA-R \(accessed: 12-2020\)](#)

[3QlJTqvpYmJXnDm \(accessed: 12-2020\)](#)

[ojDypCbvcb GBN9 \(accessed: 12-2020\)](#)

Name	Company/authors	Link
Padlet	Padlet Inc. (founded by Nitesh Goel and Pr	https://padlet.com/
Zoom (Zoom Workplace)		https://zoom.us/
Google Meet	Google LLC	https://meet.google.cor
Kahoot!	Kahoot! AS (co-founded by Johan Brand, Jai	https://kahoot.com/
Google Docs	Google LLC	https://docs.google.com/
Google Sheet	Google LLC	https://sheets.google.c

Description	Suitable for secondary	Free?	Level (1 to 5, 1:preliminary)
Padlet is a web-based visual collaboration platform that acts as an	Yes, highly suitable for middle and high	yes	1
Zoom is a cloud-based communication and collaboration	Yes, highly suitable (widely used for	yes	1
Google Meet is a cloud-based video communication service fully	Yes, highly suitable (widely used in	yes	1
Kahoot! is a game-based learning and interactive quiz platform that turns	Yes, extremely suitable (highly	yes	1
Google Docs is a cloud-based, real-time collaborative word processing	Yes, essential (the cornerstone of	yes	1
Google Sheets is a cloud-based spreadsheet application included in	Yes, highly suitable (essential for science	yes	2

Title	Link	Type
Simone Giertz	https://www.youtube.com/channel/UC3KEoMzNz8e	Entertainment
Boston Dynamics	https://www.youtube.com/user/BostonDynamics	Robotic company
James Bruton	https://www.youtube.com/user/jamesbruton	Education-entertainment
How to Mechatronics	https://www.youtube.com/user/DejanNedelkovski	Education-DIY
DroneBot Workshop	https://www.youtube.com/channel/UCzml9bXoEMC	Education-DIY
KUKA - Robots & Automation	https://www.youtube.com/user/KukaRobotGroup	Robotic company
Hanson Robotics Limited	https://www.youtube.com/channel/UCUb1bZLNfEb	Company
ABB Robotics	https://www.youtube.com/user/ABBRobotics	Robotic company
VEX Robotics	https://www.youtube.com/user/vexroboticstv	Education
SoftBank Robotics Europe	https://www.youtube.com/user/AldebaranRobotics	Robotic company
Universal Robots	https://www.youtube.com/user/UniversalRobotsVi	Robotic company
RobotshopTV	https://www.youtube.com/channel/UCedWTCvrcd	Company
Rethink Robotics	https://www.youtube.com/user/RethinkRobotics	Robotic company
Engineered Arts	https://www.youtube.com/EngineeredArts	Robotic company
Howe & Howe	https://www.youtube.com/@HoweHowe	Entertainment
Fanuc	https://www.youtube.com/@fanucamericacorporation	Robotic company
Trossen Robotics	https://www.youtube.com/@interbotixtrossenrobotics	Education-entertainment