THE USE OF EDUCATIONAL SETS OF LEGO MINDSTORMS EV3 WITH SCHOOL STUDENTS AGED 13-15

A guide written within the ERASMUS+ project

“LEGO® MINDSTORMS® EV3 IN STEM EDUCATION”
2019-1-PL01-KA229-065800

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THE SITE OF THE PROJECT
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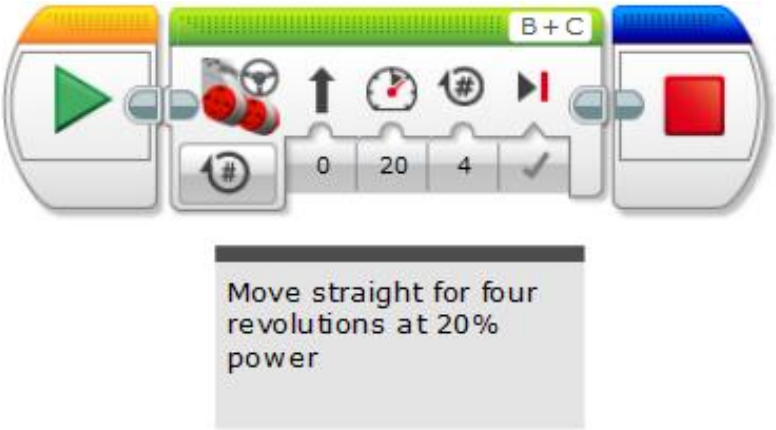
This guide, developed as part of the ERASMUS + KA229 PROJECT “LEGO® MINDSTORMS® EV3 IN STEM”, 2019-1-PL01-KA229-065800, is the result of teamwork and research done by teachers and school students (13 -15 years old) within the project. It is about the basics of building and programming robots using the LEGO Mindstorms educational system. Teenagers nowadays should have the chance to do research, and discover information about science and environment through innovative methods and tools. Thus, they will more easily become future adults who can solve the challenges the world is facing. This project gives teenagers access to quality STEM learning opportunities, which represent valuable assets for their future careers. Engaging students in STEM is essential to creating confidence and competence. Studying Robotics is a perfect way of learning mechanical design, programming and even Electronics. By attending Robotics workshops at the middle school level, students become interested in various STEM fields. This guide contains some basic LEGO MINDSTORMS building and programming guidelines for middle school students and reflect the experience of both the teachers and the student hands on experiences. This document does not replace user guides and documentation provided by LEGO. It is intended to be used for classes, workshops or after-school programs led by volunteers FOR EDUCATIONAL USE ONLY and may not be used for, or distributed to any party for any commercial purpose.

Esta guía, desarrollada como parte del PROYECTO ERASMUS + KA229 “LEGO® MINDSTORMS® EV3 IN STEM”, 2019-1-PL01-KA229-065800, es el resultado del trabajo en equipo y la investigación realizada por docentes y alumnos de escuelas (13 -15 años) en el marco del proyecto. Desarrollándose los conceptos básicos de construcción y programación de robots utilizando el sistema educativo LEGO Mindstorms. Los adolescentes de hoy en día deberían tener la oportunidad de investigar y descubrir información sobre la ciencia y el medio ambiente a través de métodos y herramientas innovadoras. Así, se convertirán en futuros adultos que podrán resolver con mayor facilidad los desafíos que enfrenta el mundo. Este proyecto brinda a los adolescentes acceso a oportunidades de aprendizaje STEM de calidad, que representan activos valiosos para sus futuras carreras. Involucrar a los estudiantes en STEM es esencial para aumentar su confianza y su desarrollo competencial. Estudiar Robótica es la manera perfecta de aprender diseño mecánico, programación e incluso electrónica. Al asistir a talleres de robótica a nivel de escuela intermedia, los estudiantes se interesan en varios campos STEM. Esta guía contiene algunas pautas básicas de construcción y programación de LEGO MINDSTORMS para estudiantes de secundaria y refleja la experiencia práctica tanto de los maestros como de los estudiantes. Este documento no reemplaza las guías de usuario y la documentación proporcionada por LEGO. Está destinado a ser utilizado para clases, talleres o programas extracurriculares dirigidos por voluntarios PARA USO EDUCATIVO ÚNICAMENTE y no puede ser utilizado ni distribuido a ninguna parte con fines comerciales.	Acest ghid, dezvoltat ca parte a PROIECTULUI ERASMUS + KA229 „LEGO® MINDSTORMS® EV3 IN STEM”, 2019-1-PL01-KA229-065800, este rezultatul muncii în echipă și al cercetării efectuate de profesori și elevi (13-15 ani) în cadrul proiectului. Este despre elementele de bază ale construirii și programarii roboților folosind sistemul educațional LEGO Mindstorms. Adolescenții din zilele noastre ar trebui să aibă șansa de a face cercetare și de a descoperi informații despre știință și mediu prin metode și instrumente inovatoare. Astfel, ei ar putea deveni viitori adulți care rezolvă mai ușor provocările cu care se confruntă lumea în care trăim. Acest proiect oferă adolescenților acces la oportunități de învățare STEM de calitate, care reprezintă atuuri valoroase pentru viitoarele lor cariere. Implicarea elevilor în STEM este esențială pentru a crea încredere și competență încă de timpuriu. Studierea roboticii este o modalitate perfectă de a învăța despre design mecanic, programare și chiar electronică. Prin participarea la ateliere de robotică la nivel de gimnaziu, elevii devin interesați de domenii STEM cât mai diverse. Acest ghid conține câteva instrucțiuni de bază pentru construirea și programarea LEGO MINDSTORMS pentru elevii de gimnaziu și reflectă experiența atât a profesorilor, cât și a elevilor implicați în proiect. Acest document nu înlocuiește ghidurile utilizatorului și documentația furnizată de LEGO. Este destinat să fie utilizat pentru cursuri, ateliere sau programe de tip școală după școală conduse de voluntari NUMAI PENTRU UTILIZARE EDUCAȚIONALĂ și nu poate fi folosit sau distribuit în niciun scop comercial.	Niniejszy przewodnik, opracowany w ramach PROJEKTU ERASMUS + KA229 „LEGO® MINDSTORMS® EV3 IN STEM”, 2019-1-PL01-KA229-065800, jest wynikiem pracy zespołowej i badań przeprowadzonych przez nauczycieli i uczniów (13 -15 lat). Zawiera informacje dotyczące podstaw budowania i programowania robotów z wykorzystaniem systemu edukacyjnego LEGO Mindstorms. Współcześni nastolatkowie powinni mieć możliwość prowadzenia badań i gromadzenia informacji o nauce i środowisku dzięki innowacyjnym metodom i narzędziom. W ten sposób staną się przyszłymi dorosłymi, którzy będą mogli łatwiej stawić czoła wyzwaniom, przed którymi stoi świat. Projekt ten zapewnia nastolatkom dostęp do wysokiej jakości możliwości uczenia się w zakresie STEM, co jest cenne w ich przyszłej karierze. Angażowanie uczniów w STEM jest niezbędne do budowania pewności siebie i rozwijania kompetencji potrzebnych we współczesnym świecie. Udział w zajęciach z robotyki to doskonały sposób na naukę projektowania mechanicznego, programowania, a nawet elektroniki. Uczestnicząc w warsztatach robotyki, uczniowie interesują się różnymi dziedzinami STEM. Ten przewodnik zawiera kilka podstawowych wskazówek dotyczących budowania i programowania LEGO MINDSTORMS i odzwierciedla doświadczenia zarówno nauczycieli, jak i doświadczenia uczniów. Ten dokument nie zastępuje podręczników użytkownika i dokumentacji dostarczonej przez firmę LEGO. Jest przeznaczony do użytku na zajęciach, warsztatach lub programach pozaszkolnych prowadzonych przez wolontariuszy WYŁĄCZNIE DO CELÓW EDUKACYJNYCH i nie może być używany ani rozprowadzany na rzecz żadnej strony w jakimkolwiek celu komercyjnym.

INTRODUCTION

Lego Mindstorms EV3 users need to download the software to program the robots. The software is available for free on its official website. Until fall 2020, the application was called Mindstorms EV3 Lab. Currently it is Mindstorms EV3 Classroom. These applications are based on different types of programming languages. The activities presented in this guide use both types of programming language. It is because of the change in 2020. Those activities which were created and conducted earlier than year 2020 are based on the EV3 Lab language arranged horizontally. Those activities which were conducted after the year 2020 are based on the Scratch language.

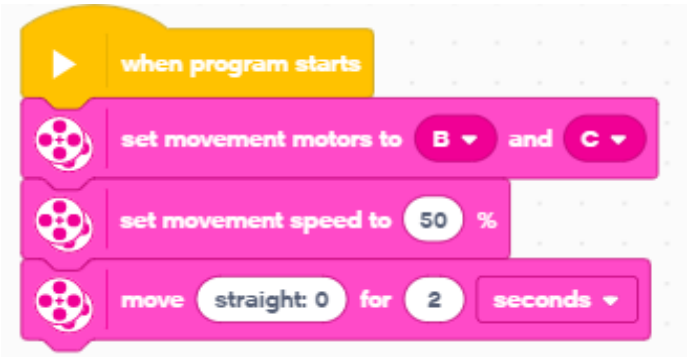
Mindstorms EV3 Lab, also known as EV3-G, was the main programming language provided by LEGO Education for the MINDSTORMS EV3 sets until fall 2020. EV3 Lab is a graphical programming language where programming blocks are arranged horizontally. It is quite different from traditional programming languages.



Derived from the https://ortop.org/wiki/images/2/2e/EV3-Lab-MoveStraight.png

Mindstorms EV3 Classroom is a graphical programming language for the Mindstorms EV3 sets. It became the standard software for the EV3 Set for those running PCs with the 64-bit version of Windows 10, Chromebooks and Macs using macOS Catalina 10.15 in the fall of 2020. The Mac version also works with macOS Mojave 10.14. Those with earlier operating systems should continue to use EV3 Lab.

EV3 Classroom is based on an educational language called Scratch and is quite similar to Word Blocks, the graphical language provided by LEGO Education for its SPIKE Prime set. LEGO Education has also announced that EV3 Classroom will become available for and Chromebooks.



Derived from thehttps://ortop.org/wiki/images/a/a0/EV3-Classroom-Sample-Program.png

Teachers' opinions of the use of EV3 in regular curricular teaching:

Strengths:

- Learning Technology and Robotics is the key for students in the 21st century.
- This is the education of the 21st century skills such as creativity, critical thinking, teamwork, problem solving.
- Building the robot with Lego blocks is very interesting for students. Everyone knows Lego blocks and finds the building part very engaging.
- They contain rechargeable batteries, which is environmentally friendly.

Weaknesses:

- The price of the set is high and you need at least five sets to plan the classes. The best option is to have students work in pairs. Teamwork with two students on the one set is very efficient.
- Building and programing the robot during one meeting is challenging and a bit time-consuming. Each challenge needs at least 90 minutes to build and program the robot. Because of that, it is quite complicated to have such lessons during regular curricular teaching. To do that, one should focus only on designing the program avoiding the building part. You might also split one challenge into 2-4 regular IT classes. Another solution is to have the Robotics classes at the end - as the last lesson of the day. The students who need more time to complete the challenge might stay longer than planned.

Ideas for teachers:

- You can use the Lego Mindstorms EV3 sets and robots during teaching other subjects than IT. The ideas of the use EV3 is available at: https://erasmus-lego-stem.weebly.com/
- You might add a little fun and competition to each challenge apart from building and programing the robot, i.e. the robot race, the robot fight.
- With less experienced groups, you might chose a program, which contains some changes / mistakes, and show it to the students. Students' job then can be to copy the program, test it and correct the changes/mistakes in order to complete the given task.

GLOSSARY LEGO MINDSTORMS EV3

ENGLISH	ROMANIAN	SPANISH	POLISH
EV3	EV3	EV3	EV3
Motor	Motor	Motor	Silnik
Sensor	Senzor	Sensor	Czujnik
Download	Descarcă	Descargar	Ściągnij
Ports	Porturi/ Mufe	Puertos	Porty
Brick	Cărămidă	Bloque	Kostka
Design	Proiectare	Diseño	Projekt
Engineer	Inginer	Ingeniero	Inżynier
Engineering Design Process	Procesul de proiectare inginerească	Proceso de diseño de ingeniería	Proces projektowania technicznego
Goal	Target/Țintă	Gol	Cel
LEGO EV3 Mindstorm Programming Software	Software de programare LEGO EV3 Mindstorm	Software de programación LEGO EV3 Mindstorm	Oprogramowanie do programowania Mindstorm LEGO EV3
EV3 Brick	Cărămidă EV3	Ladrillo EV3	Kostka EV3
Code	Cod	Código	Kod
Construct	Construiește	Construir	Skonstruować
Engineering	Inginerie	Ingenieria	Inżynieria
Firmware	Firmware	Firmware	Oprogramowanie układowe
Behaviors	Comportamente	Comportamientos	Zachowania
Interactive Servo Motor	Servomotor interactiv	Servomotor interactivo	Interaktywny silnik Servo
LEGO Mindstorms Education EV3 Programming Service	LEGO Mindstorms Education EV3 Serviciu de programare	Servicio de programación LEGO Mindstorms Education EV3	Usługa programowania LEGO Mindstorms Education EV3
Light Sensor	Senzor de lumina	Sensor de luz	Czujnik światła
Ports	Porturi /mufe	Puertos	Porty
Infrared Remote Control	Telecomandă cu infraroșu	Control remoto por infrarrojos	Pilot na podczerwień
Infrared Beacon	Beacon infraroșu	Baliza Infrarroja	Sygnalizator podczerwieni
Control the robot	Controlează robotul	Controlar el robot	Sterować robotem
Deconstruct	Dezasamblează	Deconstruir	Dekonstrukcja
EV3 Mind Storm Motors (small and large)	EV3 Mind Storm Motors (mici și mari)	Motores de tormenta mental EV3 (pequeños y grandes)	EV3 Mind Storm Motors (małe i duże)
Run	Rulează	Ejecuta	Uruchomić
Algorithm	Algoritm	Algoritmo	Algorytm
Program	Program	Programa	Program
Sequence	Secvenţă	Secuencia	Sekwencja
Variable	Variabil	Variable	Zmienna
Loop	Buclă	Bucle	Pętla
Tutorial	Instrucțiuni	Tutorial	Instrukcja

Brick

The "brain" of the robot is the brick; sensors and motors are connected to the brick with wires. The brick is then connected to a computer via a USB cable to run code written using the Mindstorms software.

Motors

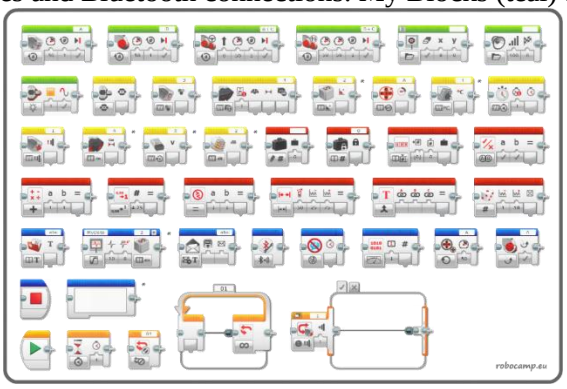
The motors have an orange or red round attachment. This attachment is connected to plus-sign pieces to which we can attach wheels or other rotating pieces.

Wires

Connect motors and sensors to ports on the brick using wires.

The blocks

The programs of the Lego Mindstorms robot are made of blocks.
Action Blocks control the actions of the program. They control motor rotations, image, sound, and light.
Flow Blocks control the flow of the program. All programs begin with the orange
Start block. Sensor Blocks allow the program to read input from the various sensors.
Data Operations Blocks controls variables and the comparison of values.
Advanced Blocks manage files and Bluetooth connections. My Blocks (teal) are user-created blocks.



This guide focuses on: The EV3 Design Engineering Projects, The EV3 Science Curriculum and The EV3 Space Challenge Curriculum. Each of these three fields needs the LEGO MINDSTORMS EV3 CORE SET and some extensions.

LEGO EV3 User Guide

https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/lego%20ev3%20user%20guide.pdf

DOWNLOADING PROGRAMS

To download a program into the robot from the computer, connect the brick via USB. Open the program, and then press the downward-pointing "download" button in the bottom right corner of the screen.
You can find the **SOFTWARE** at
https://education.lego.com/en-us/downloads/retiredproducts/mindstorms-ev3-lab/software

THE SETS

THE EV3 CORE SET contains everything you need to engage students in exciting computing, Technology, Engineering and Maths lessons. It enables them to build, program and test their solutions based on LEGO® building elements combined with real-world Robotics technology. The set contains the EV3 Intelligent Brick, a compact and powerful programmable computer that makes it possible to control motors and collect sensor feedback using the intuitive icon-based programming and data logging software that is delivered with the set. The battery charger (LEG8887) is required and it is usually not included in the pack. The software is available in both desktop and tablet app versions, you can download the software from www.legoeducation.com/download. Alternatively, you can download the software from the App Store, instructions on how to download the software are usually also included in the box. This LEGO EV3 core set contains the EV3 Intelligent Brick, a powerful small computer, making it possible to control motors and in addition collect sensor feedback. It includes Bluetooth and Wi-Fi communication ability, and provides on-brick programming and data logging. It comes in a storage box with a sorting tray for easy classroom management. Building instructions for additional models are included in the software.

The set includes:

– Three interactive servo motors
– Built-in rotation sensor and ultrasonic sensor
– Colour/light sensor, gyro sensor and two touch sensors
– Rechargeable battery
– Ball wheel
– Connecting cables
– Building instructions
– LEGO® Technic building bricks for creating a vast variety of models

Key Learning Points:

– Design and build programmable robots using motors, sensors, gears and more
– Build, test, troubleshoot and revise designs to improve robot performance
– Gain practical, hands-on experience using mathematical concepts
– Communicate effectively using scientific and technical language

This set stimulates the student's engagement and energises learning through real-life problem solving. You can be up and running in less than 45 minutes, fully supported by the 48 step-by-step tutorials and a guide to all the programming language and hardware functions.

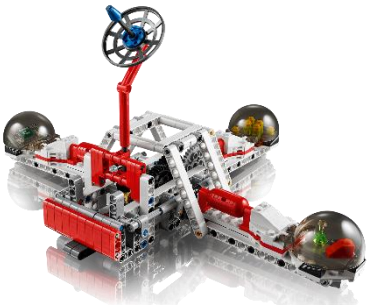
LEGO EV3 Coding Activities :
https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/lego%20ev3%20coding%20activities%20incl%20au%20curriculum.pdf
LEGO EV3 Design Engineering Projects Teacher Intro Guide:
https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/lego%20ev3%20design%20engineering%20projects%20teacher%20intro%20guide.pdf
LEGO EV3 MAKER Activities incl AU Curriculum:
https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/lego%20ev3%20maker%20activities%20incl%20au%20curriculum.pdf
LEGO EV3 Science Activities - Teacher Guide Introduction:
https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/lego%20ev3%20science%20activities%20-%20teacher%20guide%20introduction.pdf

The LEGO® MINDSTORMS EV3 Space Challenge Set 45570 contains challenges and learning missions based around the theme of space. Three research projects, co-developed with space experts, provide rich opportunities for students to explore and create innovative solutions to current space exploration topics. The set includes three learning mats, a challenge mat, dual lock tape, and all of the LEGO elements required to build the challenge models. The accompanying digital content provides student-ready materials, teacher notes, and building instructions. Requires the LEGO MINDSTORMS Education EV3 Core Set. The age Level is 10+ years.

KEY LEARNING VALUES:

Use the Space Challenge Set to teach your students STEM concepts in a fun, structured way for your students to learn how to:

- Solve real-world problems
- Develop solutions through teamwork
- Build, test and evaluate robots
- Experience hands-on programming and working with sensors, motors as well as intelligent units



One Space Challenge set is suitable for 6 - 30 pupils, it provides 30+ hours of classroom instruction and STEM learning, it includes challenge missions and research projects co-developed with space experts and it integrates into the EV3 Software.

In the units that can be designed with this set, the students can work as scientists and engineers. They'll immerse themselves in motivating STEM activities that prompt creative problem-solving, communication, and teamwork. They'll work on the Challenge Mat, an engaging and motivating platform where they'll creatively apply their STEM knowledge and expand their problem-solving skills as they develop their Space Challenge solutions.

Lessons: (https://education.lego.com/en-us/lessons/ev3-space-challenge)

Get Ready to Go to Mars:
https://education.lego.com/en-us/lessons/ev3-space-challenge/1-get-ready-to-go-to-mars#lesson-plan

Activate Communications:
https://education.lego.com/en-us/lessons/ev3-space-challenge/2-activate-communications#lesson-plan

Assemble Your Crew:
https://education.lego.com/en-us/lessons/ev3-space-challenge/3-assemble-your-crew#lesson-plan

Free the MSL Robot:
https://education.lego.com/en-us/lessons/ev3-space-challenge/4-free-the-msl-robot

Launch the Satellite:
https://education.lego.com/en-us/lessons/ev3-space-challenge/5-launch-the-satellite

Return the Rock Samples:
https://education.lego.com/en-us/lessons/ev3-space-challenge/6-return-the-rock-samples

Secure the Power Supply:
https://education.lego.com/en-us/lessons/ev3-space-challenge/7-secure-the-power-supply

Initiate Launch:
https://education.lego.com/en-us/lessons/ev3-space-challenge/8-initiate-launch

LEGO EV3 Space Challenge Teacher Intro Guide
https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/lego%20ev3%20space%20challenge%20teacher%20intro%20guide.pdf

LEGO® MINDSTORMS® EV3 31313

Combining the versatility of the LEGO® building system with the most advanced technology ever developed, LEGO MINDSTORMS® EV3 31313 lets you unleash a world of walking, talking and thinking robots that do anything you can imagine. You can complete a series of challenging missions using the intuitive icon-based EV3 Programmer App for tablet devices to build and program TRACK3R, R3PTAR, SPIK3R, EV3RSTORM and GRIPP3R, and then create your own programs. It takes your robotics skills to the next level with the companion EV3 Software for PC and Mac, with its more advanced yet familiar programming interface. For instant control, you can download the free Robot Commander app for smart devices or use the infrared remote control included with each set. If you want to share your own creations and be inspired by others? Log on to LEGO.com/MINDSTORMS to access a world of exciting content and interact with a huge online community of LEGO MINDSTORMS fans. Build and program walking, talking and thinking robots that do anything you can imagine. It includes Intelligent EV3 Brick & three servo motors, plus colour, touch and IR sensors SPIK3R is over 16” high, 14” long and 15” wide. LEGO MINDSTORMS building toys are compatible with all LEGO construction sets for creative building. 601 pieces – For 10+ years old.

Building Instructions: https://www.lego.com/en-us/service/buildinginstructions/31313

Learn to program LEGO MINDSTORMS tutorials on youtube

V3 Intro Tutorial: https://www.youtube.com/watch?v=6BOwl1P-BOU&t=180s
How to create your first program : https://www.youtube.com/watch?v=81hctQt6Cp8
How to make your robot move: https://www.youtube.com/watch?v=liKa_I55ADM
How to make your robot react: https://www.youtube.com/watch?v=QYHYA-_d-8M&t=1s
How to make your robot drive: https://www.youtube.com/watch?v=8C01X72_Xfk&t=2s
Getting Started With The LEGO Mindstorms EV3 Ultrasonic Sensor:
https://www.youtube.com/watch?v=wmwfiPomPGk&t=212s
Lego Mindstorms EV3 Robotics – Loops: https://www.youtube.com/watch?v=aNro_0R4854

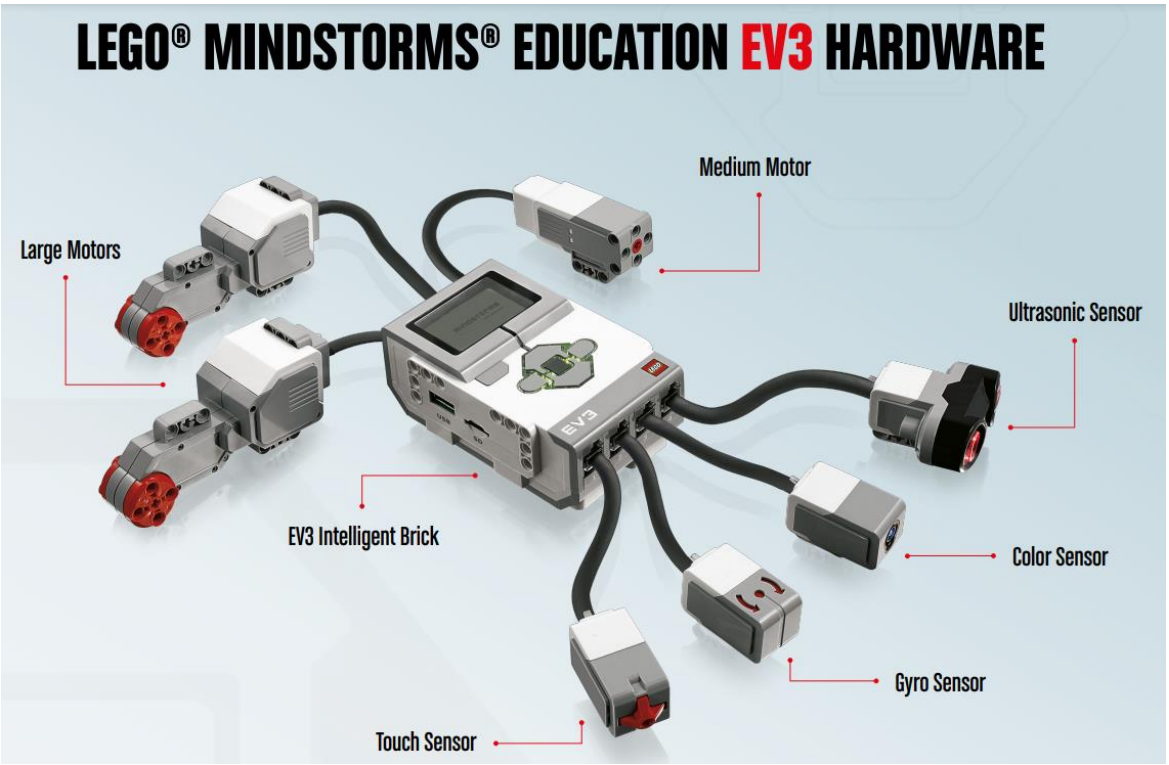
CHRISTMAS SPECIALS:

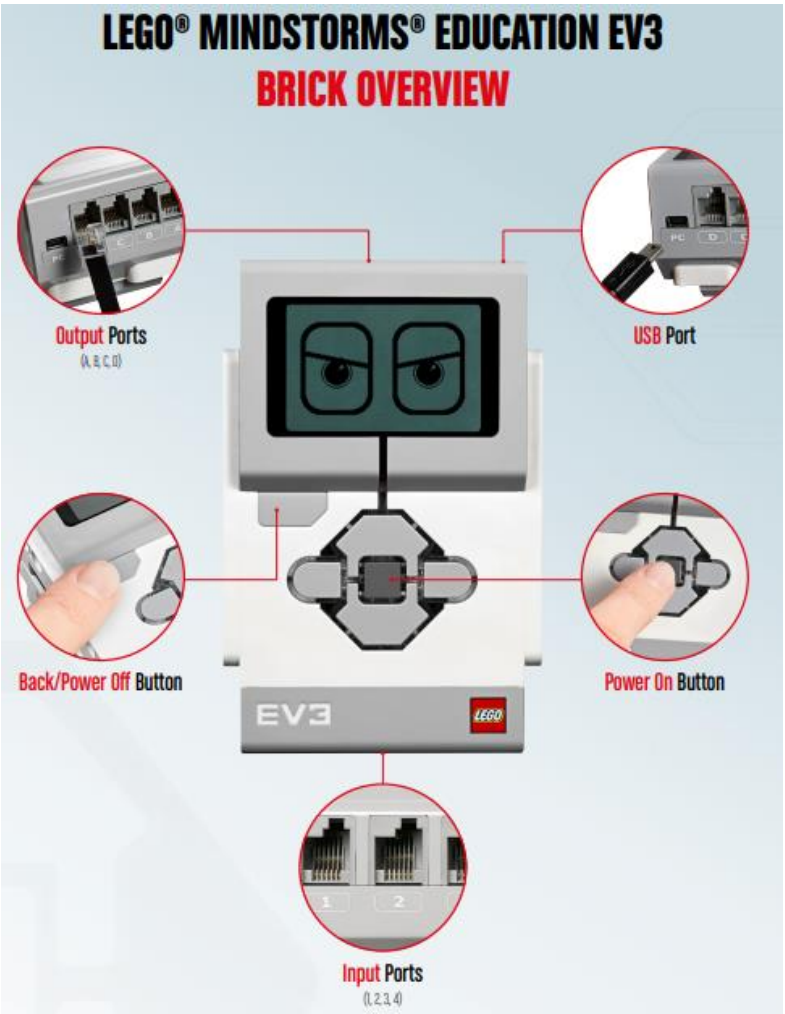
Santa's Sleigh with LEGO Mindstorms EV3 - online lesson:

https://www.youtube.com/playlist?list=PLzuIZDsIT16DCblvY5nSy752Vm4XO77Fr

CLASSROOM POSTERS

https://education.lego.com/en-us/product-resources/mindstorms-ev3/teacher-resources/classroom-materials





CHECKLIST

- [ ] Software is installed
- [ ] Software has been opened once to check that it loads properly
- [ ] LEGO® bricks have been sorted
- [ ] Box and electronic components have been labeled
- [ ] The EV3 Rechargeable Battery or AA batteries have been installed in the EV3 Brick
- [ ] The EV3 Rechargeable Battery has been charged
- [ ] EV3 Brick has been renamed

Let's Prepare

- [ ] I know how to drag icons to the Programming Canvas.
- [ ] I know how to change the parameters on a programming block.
- [ ] I can turn a motor on and off.
- [ ] I can use the Touch Sensor.
- [ ] I can use the Color Sensor.
- [ ] I can use the Ultrasonic Sensor.
- [ ] I can turn the EV3 Brick on and off.
- [ ] I know the difference between an output port and an input port on the EV3 Brick.

Let's Try

Find more support online:

www.legoeducation.com/support

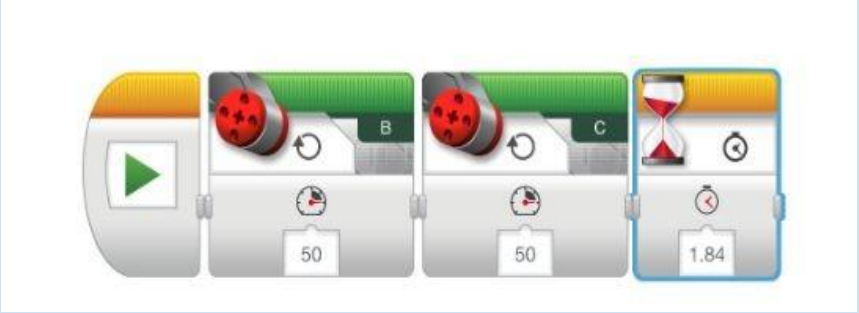
CHALLENGES FROM PARTENERS WITHIN THE PROJECT

Moving Straight: Advanced 50 cm with two motors

Challenge DESCRIPTION: From the start point move the robot 50 cm straight forward . Move forward at 50% power.

Challenge Video Link: https://youtu.be/NjHCrqeYdcA

Challenge PROGRAM:



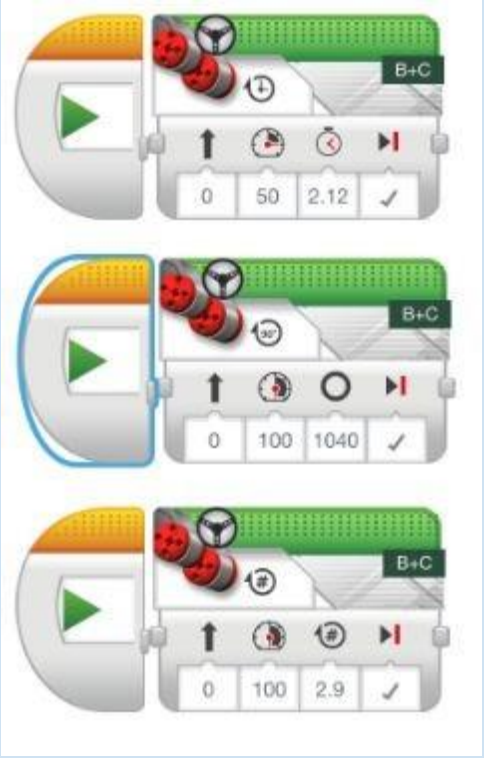
Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
Lo que tenemos que haceres crear dos bloques verdes. Uno para el motor B y otropara el C y además de esotienes que poner 50 de potencia en los dos motores. Para asegurar que hace los 50 cm insertaun bloque de 1,3 segundos.	Ceea ce trebuie să facem este să atașăm două blocuri verzi. Unul pentru motorul B și unul pentru motorul C și trebuie să punem si valoarea 50 la putere în ambele motoare. Pentru a ne asigura că face 50 cm, introducem un bloc de 1, 3 secunde.	Musimy stworzyć dwa zielone bloczki. Jeden bloczek dla silnika B i jeden dla silnika C, a do tego trzeba ustawić prędkość „50” dla obu silników. Aby być pewnym, że robot przejedzie dystans 50 cm, z usawioną wcześniej prędkością „50” dodajemy bloczek i ustawiamy czas o długości 1,3 sekundy.

Moving Straight: Advanced 50 cm with steering block

Challenge DESCRIPTION: From the start point move the robot 50 cm straight forward. Move forward at 50% power. Use the three possibilities time, degrees and turnings.

Challenge Video Link: https://youtu.be/oNaaSUkSrdA

Challenge PROGRAM:



Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot avanza 50 cm. Se realiza de tres formas con tiempo, gradosy rotaciones.	Robotul avansează 50 cm. Acest lucru se poate face în trei moduri ajustând valorile pentru timp, grade sau rotații.	Robot porusza się do przodu o 50 cm. Odbywa się to na trzy sposoby z czasem, stopniami i rotacjami.

Moving Straight: Advanced 50 cm with tank bock

Challenge DESCRIPTION: From the start point move the robot 50 cm straight forward. Move forward at 50% power.

Challenge Video Link: https://youtu.be/ZlCKRhWFhWE

Challenge PROGRAM:

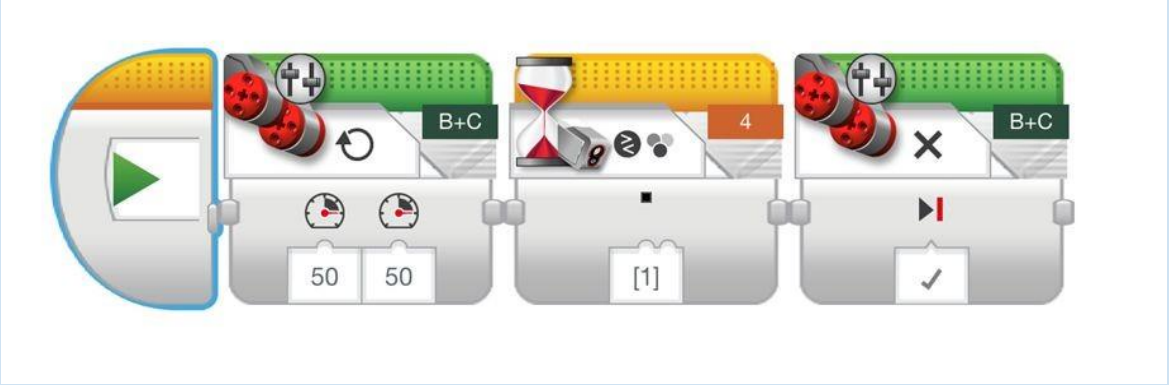
Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot avanza 50 cm.con el bloque tanque.	Robotul avanseaza 50 cm. cu blocul „Move tank”.	Robot jedzie do przodu 50 cm z blokiem „Move tank”

Color sensor: Black line detector

Challenge DESCRIPTION: The robot goes forward until see the blackline. Finally it stops.

Challenge Video Link: https://youtu.be/h8kaD-72gTs

Challenge PROGRAM:



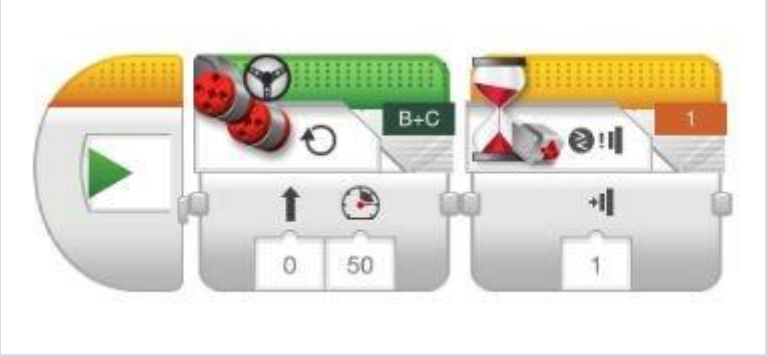
Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot avanza en línearecta hasta encontrar la línea negra.	Robotul avansează în linie dreaptă până întâlnește linia neagră.	Robot porusza się po linii prostej, aż znajdzie czarną linię

Touch sensor: Wall detector

Challenge DESCRIPTION: The robot goes forward until touch a wall. Finally it stops. We have a steering block that advances straight ahead. And we have a waiting block, so that when it touches the wall, it stops.

Challenge Video Link: https://youtu.be/uwk683uCEis

Challenge PROGRAM :



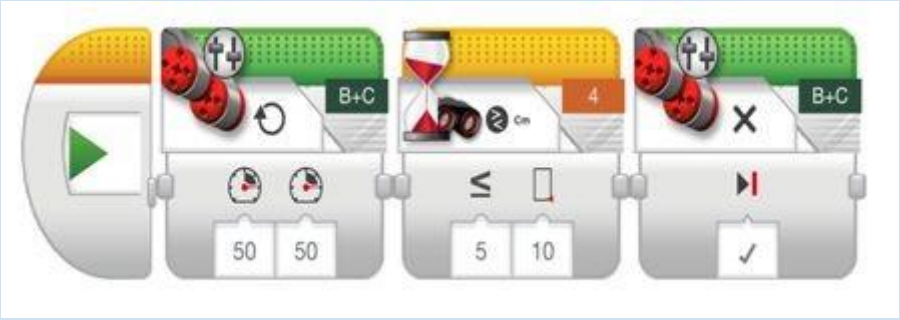
Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot avanza en línea recta hasta que choca con la pared.	Robotul se mișcă în linie dreaptă până când lovește peretele.	Robot porusza się w linii prostej, aż uderzy w ścianę.

Ultrasonic sensor: An object 5 centimeters away

Challenge DESCRIPTION: The robot goes forward until see an object 5 centimeters away. Finally it stops.

Challenge Video Link: https://youtu.be/21-euuhSFHE

Challenge PROGRAM :



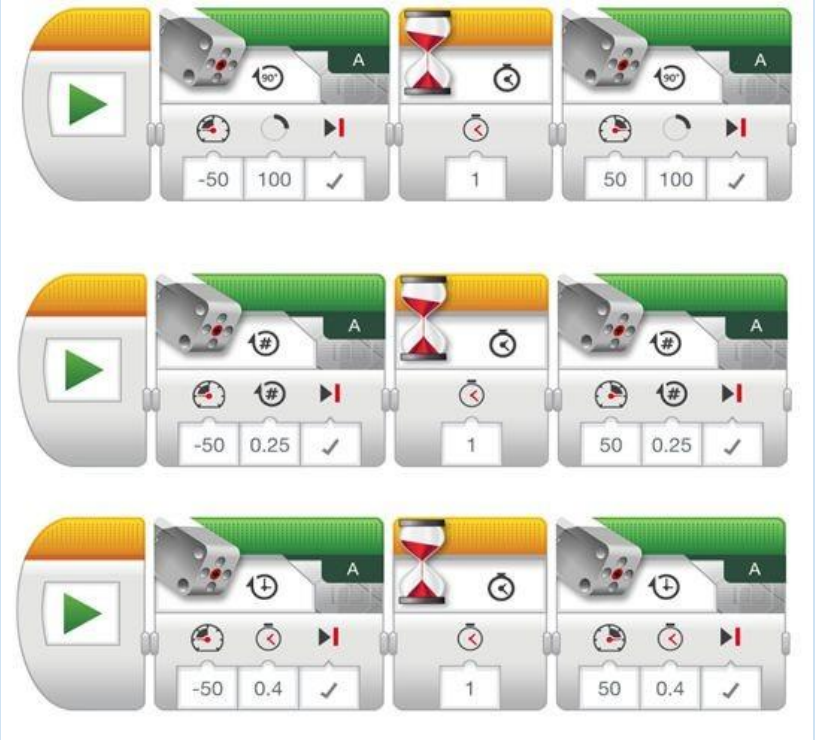
Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot avanza hasta que ve un objeto a cinco centímetros de distancia y luego para. Primero he colocado un bloque que hace que el robot vaya recto, luego, hepuesto un bloque que es el ultrasonic sensor que detecta objetos, y por último, cuando detecta el objeto a cinco centímetroshe colocado un bloque de parada	Robotul se deplasează înainte până când vede un obiect la doi centimetri distanță și apoi se oprește. Mai întâi am așezat un bloc care face robotul să meargă drept, apoi am plasat un bloc care reprezintă senzorul cu ultrasunete care detectează obiecte și, în final, când detectează obiectul la cinci centimetri am plasat un bloc de oprire.	Robot porusza się do przodu, aż zobaczy obiekt oddalony o dwa cale, a następnie się zatrzymuje. Najpierw umieściłam bloczek, który sprawia, że robot porusza się prosto. Następnie umieściłam bloczek, który jest czujnikiem ultradźwiękowym wykrywającym obiekty. Na końcu, gdy wykryje obiekt w odległości pięciu centymetrów, umieściłem blokadę.

Medium motor block: Up and down the arm

Challenge DESCRIPTION: Move the robot arm down. Wait 1 second and lift the robot arm again. To program the movement of the arm use the three possibilities: degrees, turnings and time.

Challenge Video Link: https://youtu.be/u0aq-0XfrB0

Challenge PROGRAM :



Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
Realizaremos un programa para hacer queel robot suba y baje el brazo de tres formas distintas: grados, rotaciones y tiempo.	Vom realiza un program pentru a face robotul să ridice și să coboare brațul în trei moduri diferite: în funcție de valoarea introdusă la grade, rotații și timp	Stworzymy program, który sprawi, że robot będzie podnosił i opuszczał ramię na trzy różne sposoby: stopnie, obroty i czas.

Loop: Follow the foot

Challenge DESCRIPTION: The robot follows the foot. When it sees the foot, it stops. In case it does not see the foot, it goes forward.

Challenge Video Link: https://youtu.be/kgObvSDmZZg

Challenge PROGRAM :

Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot sigue el pie y se para cuando lo ve a una distancia de 20 cm.El robot avanza y cuandole pongo un objeto por delante (el pie), el robot para. Cuando muevo el pie para delante, el robot lo sigue. Si yo quito el pieel robot continua ,pero si lo vuelvo a poner el robot vuelve a parar y así sucesivamente.	Robotul urmărește piciorul și se oprește când îl vede la o distanță de 20 cm. Robotul avansează si când punem un obiect in fața lui (piciorul), robotul se oprește. Când mișc piciorul înainte, robotul îl urmează. Dacă iau piciorul, robotul continuă, dar dacă îl pun la loc, robotul se oprește din nou și așa mai departe.	Robot jedzie do przodu i zatrzymuje się, gdy zobaczy stopę z odległości 20 cm. Robot jedzie do przodu, a kiedy kładę przed nim jakiś przedmiot (np. stopę), robot zatrzymuje się. Kiedy poruszam stopą do przodu, robot jedzie do przodu. Jeśli zdejmę stopę, robot kontynuuje pracę, ale jeśli położę ją z powrotem, robot znów się zatrzyma i tak dalej.

Turning 90 º with two motors

Challenge DESCRIPTION: The robot turns an accurate angle of 90º. Usethe three possibilities: turnings, degrees and time.

Challenge Video Link: https://youtu.be/e_BZ3gnEl5A

Challenge PROGRAM :

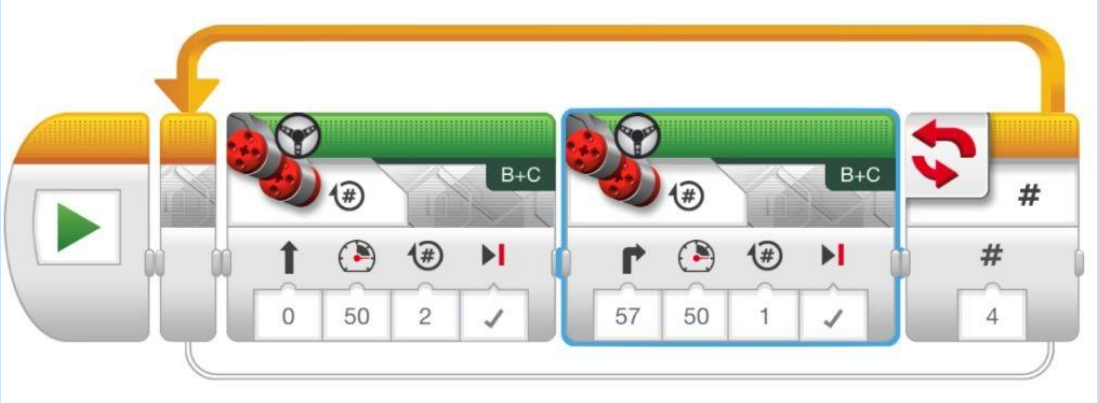
Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot gira un ángulo exacto de 90º. Se realizael programa de tres formas distintas :rotaciones, grados ytiempo	Robotul se rotește exact un unghi de 90°. Programul se poate realiza în trei moduri diferite: în funcție valoare introdusă la numărul pentru rotații, grade sau timp	Robot obraca się dokładnie pod kątem 90º. Program realizowany jest na trzy różne sposoby: obroty, stopnie i czas.

Loop: Follow a square

Challenge DESCRIPTION: The robot follow a square on the floor.

Challenge Video Link: https://youtu.be/6NQ_bFD7JRY

Challenge PROGRAM :



Spanish Challenge Description	Romanian Challenge Description	Polish Challenge Description
El robot avanza siguiendo un cuadradoen el suelo.	Robotul avansează trasând un pătrat pe podea.	Robot porusza się po podłodze tworząc kwadrat.

USEFUL LINKS FOR LEGO MINDSTORMS EV3 USERS

EV3 lessons ideas

http://ev3lessons.com/es

https://d4iqe7beda780.cloudfront.net/resources/static/main/pdf/leg45544-4s_ev3_maker_activities.pdf

http://www.nxtorm.es/ayudas/ay-s2matematicas_EV3.html

https://stemrobotics.cs.pdx.edu/

https://www.cmu.edu/roboticsacademy/PDFs/Curriculum/Intro-to-EV3/EV3-teachers-guideWEB.pdf

EV3 tutorials and components

https://ev3-help-online.api.education.lego.com/Education/en-us/index.html

https://juegosrobotica.es/

https://www.techmonkeybusiness.com/Tutorials.html

https://search.cmu.edu/?form_id=basic-form&site=&ie=UTF-8&q=ev3&site=roboticsacademy

https://stemrobotics.cs.pdx.edu/

https://makecode.mindstorms.com/#e%20ditor

Research

https://www.grasp.upenn.edu/programs/gems-engineering-math-and-science-program/

Free Robotics courses

https://learningpath.org/articles/Free_Online_Robotics_Engineering_Courses_from_Top_Universities.html

https://sites.google.com/site/gask3t/robotics-courses

https://www.ttu.edu/search/?query=EV3

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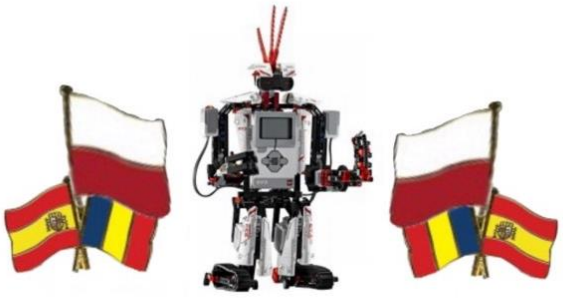
https://education.lego.com/en-us/product-resources/mindstorms-ev3/teacher-resources/classroom-materials
https://www.toytag.com/products/lego-mindstorms-education-ev3-space-challenge-set
https://www.devoxx4kids.org/materials/workshops/lego-mindstorms/
https://www.teaching.com.au/product/LEG45544-1#
https://education.lego.com/en-us/lessons/ev3-space-challenge

LEGO MINDSTORMS EV3



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STEM EDUCATION

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