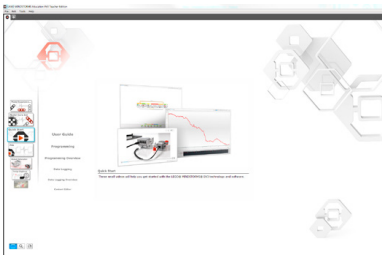
Introduction

LEGO® Education is pleased to bring you LEGO MINDSTORMS® Education EV3!

Since the beginning of this century, LEGO MINDSTORMS Education has led the way in STEM (Science, Technology, Engineering, and Math) Education, inspiring users to engage in fun, hands-on learning. The combination of LEGO building systems with the LEGO MINDSTORMS Education EV3 technology now offers even more ways to learn about robotics, and teach the principles of programming, physical science, and mathematics.

The heart of LEGO MINDSTORMS Education is the EV3 Brick, the programmable intelligent brick that not only controls motors and sensors, but also provides wireless communication.



The LEGO MINDSTORMS Education EV3 Software has everything you need to help you get started. The EV3 Software Lobby gives you easy access to content, programming, Data Logging, digital workbooks and more. Choose to follow the Robot Educator tutorials and you will be able to create, program, and run a robot before you know it! The intuitive icon-based programming interface is full of challenging possibilities, while the Data Logging environment provides a powerful tool for scientific inquiry and experiments. LEGO Education also offers a growing number of EV3-based curriculum packages developed by experienced educators.

What Is in the Box?

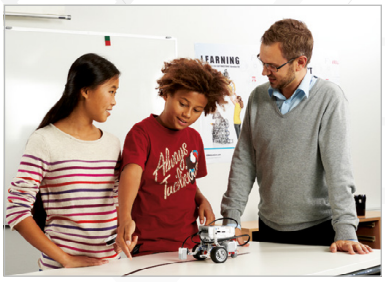
The LEGO MINDSTORMS Education Core Set consists of:

- One Intelligent EV3 Brick
- One Medium Motor
- Two Large Motors
- One Gyro Sensor
- One Ultrasonic Sensor
- One Color Sensor
- Two Touch Sensors
- A large collection of carefully selected LEGO elements

All 541 elements are listed on the supplied element overview for easy recognition and ease of management.

Combine the elements using the printed Building Instructions to create a powerful, intelligent, and fun robot. The large selection of elements lets you construct, modify, and personalize your robot to suit any experiment.

Introduction to Robot Educator



LEGO® Education is pleased to bring you Robot Educator – a selection of tutorial activities that presents a structured and fun way of getting started with your LEGO MINDSTORMS® Education EV3.

Who Is It For?

Robot Educator is a valuable tool for anyone who wishes to learn more about how to use LEGO MINDSTORMS Education EV3.

What Is It For?

The tutorials for the LEGO MINDSTORMS Education EV3 Software focus on Computer Science, Science, Mathematics, Technology and Engineering. They also provide opportunities to integrate cross-curricular activities, such as science and mathematics, when students complete the Challenges.

The engaging and motivating nature of the EV3 Software will enable students to construct and program, as well as provide them with the scope to experiment, without any prior knowledge or experience with programming or building.

Regardless of your individual goals, Robot Educator is a great point of reference and a gateway to the essentials of the LEGO MINDSTORMS Education EV3 Software and hardware. Robot Educator guides and supports teachers and students through structured tutorials, and hones building and programming skills, from the basics to more advanced topics.

What Is Robot Educator?

Robot Educator is comprised of forty-eight engaging and motivating multimedia-rich tutorials that will get teachers and students off to the best possible start.

They include:

- Multiple model animations of the EV3 Robot
- Interactive animations that help make the connection between programming and robot behavior
- Sixteen modular Building Instructions
- A 'Modify It' task that tests the students' understanding of the tutorial, and helps consolidate the learning outcome
- Links to relevant help text and user guide topics
- Hints and sample solutions for the busy educator

Robot Educator is comprised of the following categories:

Basics
Learn how to control the Driving Base and trigger events based on input from the various sensors. The Introduction to Robotics Lesson Plan PDF covers most of this.

Beyond Basics
Grasp the fundamentals of more complex topics, such as program loops, switches, multiple switches, arrays, and data wires.

Hardware
Familiarize yourself with the Intelligent EV3 Brick and its assorted sensors and motors.

Data Logging
Master various Data Logging concepts, such as live and remote Data Logging, Graph Programming, and Dataset Calculation.

Tools
Learn how to use the various tools that are included.

Robot Educator

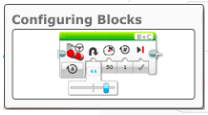
Robot Educator Overview

Please see page 17.

How Do I Get Started?

1. Take a look at the Quick Start Videos. The **Programming** Video and **Programming Overview** Video are recommended for most users, but we suggest watching all of the Quick Start Videos to gain a good understanding of the capabilities of the LEGO® MINDSTORMS® Education EV3 Software.

2. Complete the **Configuring Blocks** tutorial in the **Basics** Category. This tutorial explains how to configure programming blocks – a fundamental concept used throughout the other tutorials. The Introduction to Robotics Lesson Plan PDF covers most of the **Basics** Category.

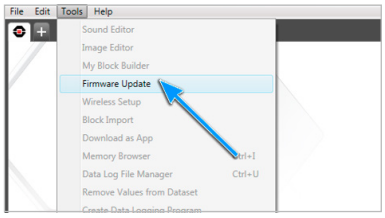


3. Choose a route that suits your needs and select the tutorials that you wish students to start with (see 'Suggested Lesson Planning Routes' later in this introduction). Try out some of these tutorials to familiarize yourself with this approach.

4. Ensure that each student computer has a preinstalled student version of the LEGO MINDSTORMS Education EV3 Software. Refer to the readme.txt file for installation instructions. In order to find out which version is installed, look in the top bar of the Software.

5. Ensure that each EV3 Brick is fully charged and has the latest firmware installed.

Firmware Update



6. It is very important for students to understand the relevance of the elements in the brick set. Discuss the naming and basic functionality of the key hardware components, and establish a set of brick management rules.

The User Guide is your source for everything relating to the LEGO MINDSTORMS EV3 hardware.

Help text links are provided for students within each tutorial.

Classroom Management Tips

How Much Time Do I Need?
The time taken to complete each of the tutorials depends on a number of factors, including the level of complexity, the age of the student, as well as the student's experience with LEGO® MINDSTORMS® and the concepts covered in the relevant tutorial. The following estimates are therefore based on the time it would take an average student, with no prior experience with LEGO MINDSTORMS, to complete a tutorial in each of the following categories:

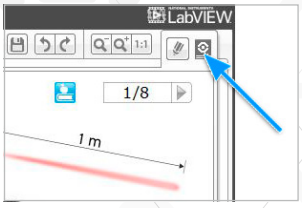
Category	Estimated Completion Time* (in minutes)
Basics	20
Beyond Basics	35
Hardware	20
Data Logging	20
Tools	15

*These times do not include building the model, which is required in order to complete a tutorial. Add approximately 20 minutes for tutorials requiring the Driving Base, and approximately 10 minutes for those requiring the EV3 Brick.

Based on the estimate above, it should be possible for your students to complete the first Driving Base tutorial within a 45-minute class period.

Classroom Management Tips

Use the Content Editor to Create Customized Tutorials
The integrated Content Editor gives you the ability to customize the tutorials supplied within Robot Educator in order to create your own set of differentiated lessons.



Here are a few ways that you could customize the tutorials:

- Rephrase the text to better match the reading ability of your students
- Add images that are more relevant to your students
- Add additional tasks to challenge groups that complete the tutorials quickly

To ensure that you do not overwrite the tutorials supplied with the LEGO® MINDSTORMS® Education EV3 Software, any changes you make will be saved as a new tutorial. All of the files included with the original tutorial will also be included in the new project file, which you are then free to share with your students (for example on a shared network drive).

Use the Content Editor as a Student Documentation Tool
The Content Editor also allows students to document their progress and findings as they work through each tutorial.

The Content Editor allows them to:

- Write full descriptions of their working processes
- Insert their own pages
- Add images and videos of their robot in action
- Share their unique project with other students

For more information on the Content Editor, watch the Content Editor Quick Start Videos.

Suggested Lesson Planning Routes

There are many ways to utilize the Robot Educator to reach your specific teaching goals. In the following pages, we have provided you with five lesson-planning routes, which allow you to tailor your coursework to suit different student audiences.

Introduction to Robotics Lesson Plan

The aim of this route is to give students the knowledge they need to manipulate the hardware and software components that make up the LEGO® MINDSTORMS® Education EV3 Software and Robot Educator.

First, have the students watch the programming-related Quick Start Videos to familiarize themselves with the EV3 Software interface. Next, lead them through the seven lesson plans that cover the Basics of Robot Educator. Then, improve your students' skills and make them even more familiar with the various sensors by having them complete the two Master Challenges and the four open-ended Design Brief Challenges.

To allow the students to create even more complex programs, have them complete the **Multitasking**, **Loop**, and **Multiple Switch** tutorials in the **Beyond Basics** Category.

The Introduction to Robotics Lesson Plan PDF is located in the Lobby Teacher's Support section.

Introduction to Robotics Lesson Plan
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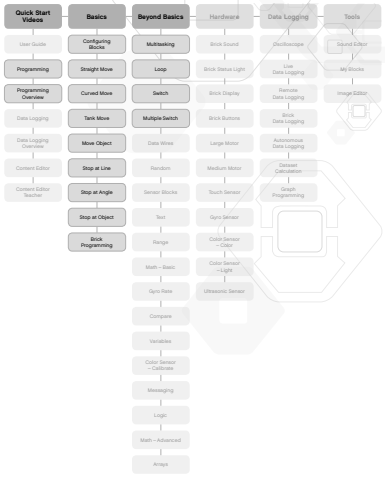

Introduction to Robotics Lesson Plan

Computer Science
This route teaches pre-computer science students the fundamentals of programming using the Robot Educator and Gyro Sensor hardware. The LEGO® MINDSTORMS® Education EV3 Software is based on LabVIEW, the industry-leading graphical programming environment used by scientists and engineers worldwide. This graphical programming approach has proven to provide a solid foundation for students learning textual programming.

First, give the students a grounding in the interface by having them watch the programming-related Quick Start Videos. Then, walk them through the **Configuring Blocks** tutorial in the **Basics** Category.

Next, introduce the students to the sensor's Angle and Rate modes by having them complete the **Gyro Sensor** and **Gyro Rate** tutorials in the **Hardware** and **Beyond Basics** Categories.

To teach the students the fundamentals of graphical programming, have them complete the following **Beyond Basics** tutorials: **Multitasking, Loop, Switch, Data Wires, Variables, Arrays, Math – Basic** and **Math – Advanced.**

Computer Science
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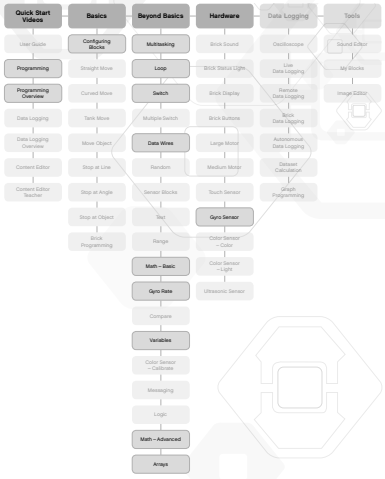

Computer Science

Science
As the name suggests, this route is aimed at science students. It gives students a basic understanding of some of the hardware sensors included with the LEGO® MINDSTORMS® Education EV3 Core Set. It also teaches them about collecting and analyzing data logged by the sensors.

First, have the students complete the **Gyro Sensor**, **Color Sensor – Light** and **Ultrasonic Sensor** tutorials in the **Hardware** Category.

Next, teach the students the fundamentals of logging data via the Intelligent EV3 Brick by completing the **Brick Data Logging** tutorial in the **Data Logging** Category. Have them also watch the Quick Start Videos that introduce the Data Logging application.

The next step is to give the students more hands-on experience with the EV3 Software. Have them complete the **Oscilloscope**, **Live Data Logging** and **Remote Data Logging** tutorials in the **Data Logging** category.

For students wishing to go further, the **Dataset Calculation** and **Graph Programming** tutorials demonstrate the real power of the Data Logging application.

Science
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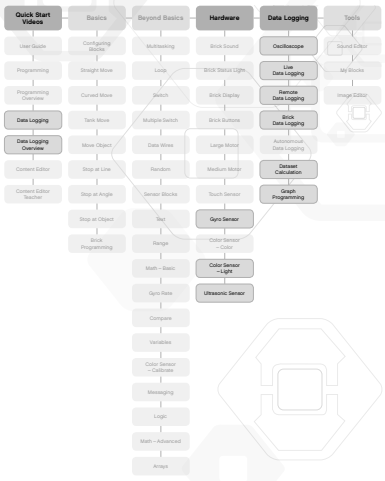
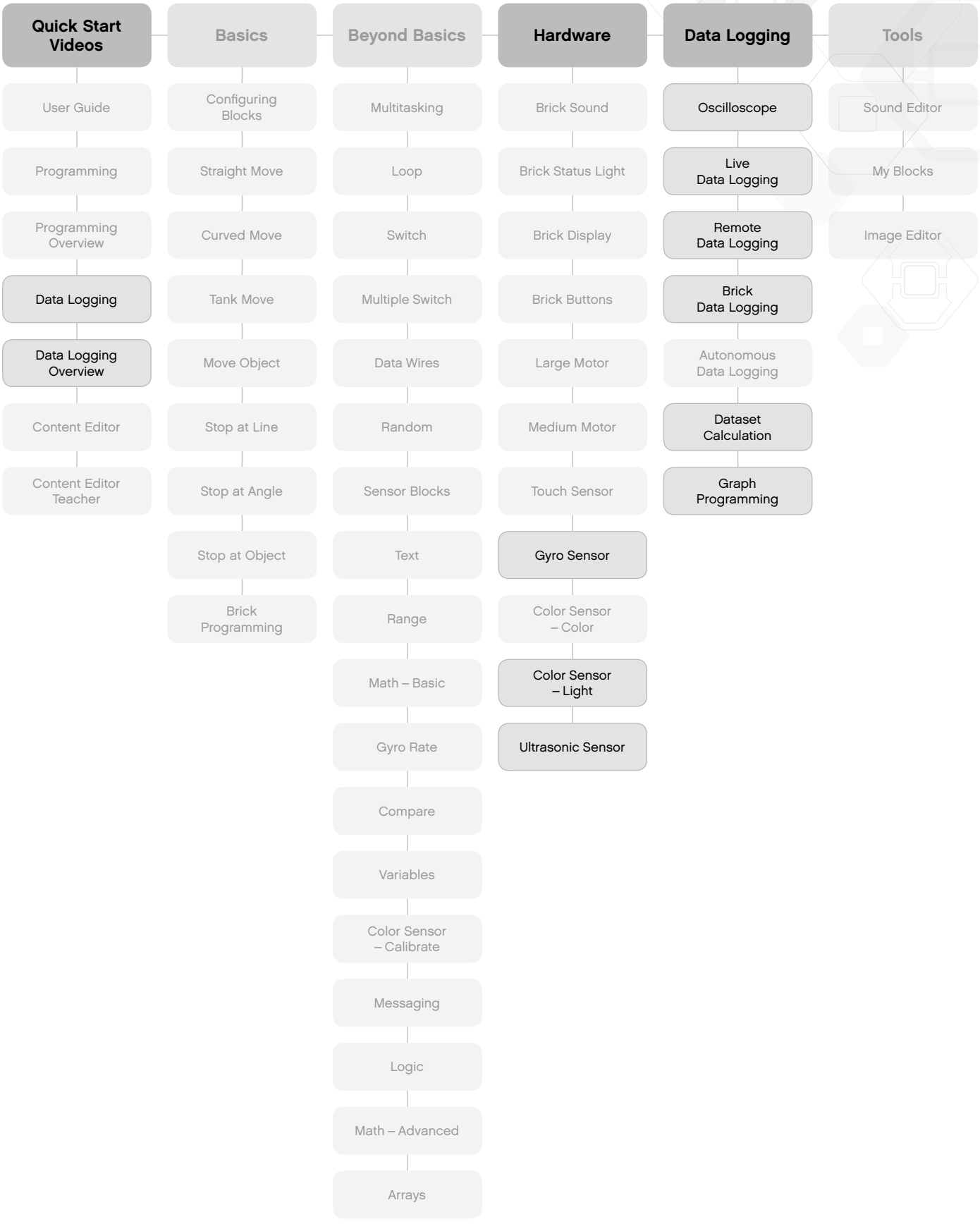


Science



Mathematics

This route provides students with a selection of tutorials that touches on the basic use of mathematics. This includes randomizing, defining a range, angles and rotational angle, as well as basic mathematics operations that calculate speed and trigonometry to navigate the Driving Base.

First, have them watch the Quick Start Video, **Programming Overview**, which introduces the EV3 Software.

Next, have the students complete the **Configuring Blocks** tutorial in the **Basics** category, the **Gyro Sensor** tutorial in the **Hardware** category, as well as the **Stop at Object** tutorial in the **Basics** Category, to ensure they know how the Gyro and Ultrasonic Sensors function.

The next step is to have the students complete more mathematics-oriented tutorials, such as **Random**, **Range**, **Gyro Rate** and **Math – Basic** in the **Beyond Basics** Category.

For students wishing to go further, the **Math – Advanced** tutorial demonstrates the real power of the EV3 Software.

Mathematics

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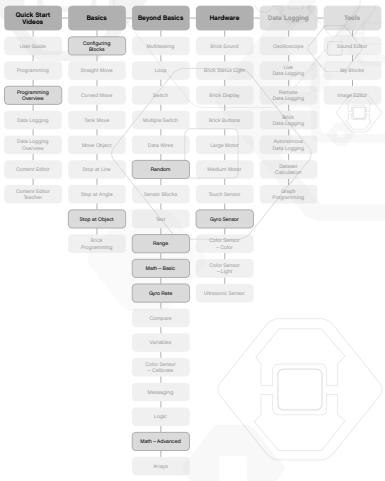
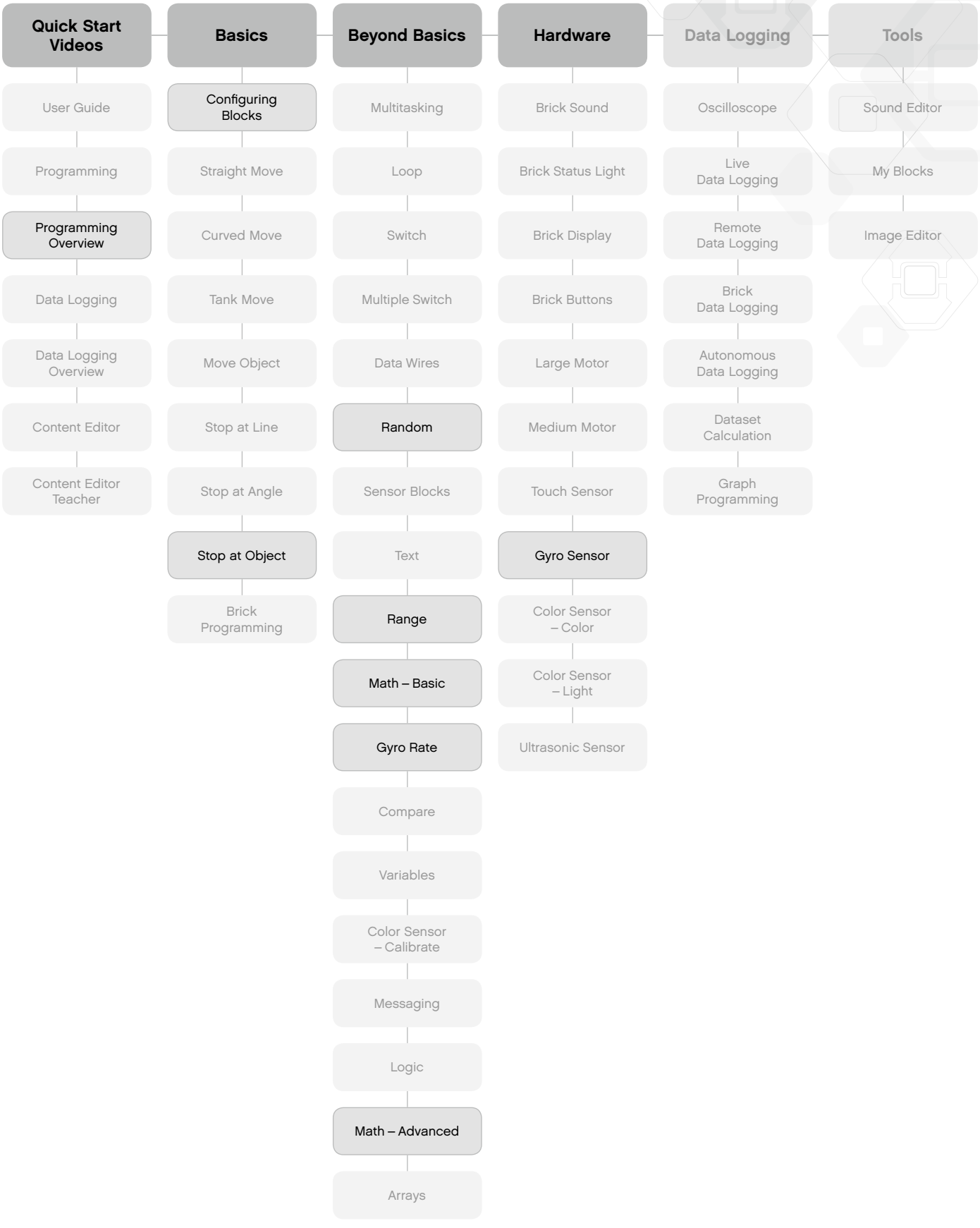


Mathematics



Technology / Engineering
This final route gives your students a series of tutorials that applies the LEGO® MINDSTORMS® Education concept to technology and engineering classes. The focus is on getting to know the hardware and its basic operation by carrying out simple programming tutorials.

First, have the students watch the Quick Start Video, **Programming Overview**, which introduces the EV3 Software.

Next, have them complete the **Configuring Blocks** tutorial in the **Basics** Category and the tutorials in the **Hardware** Category to ensure that they know how the hardware functions and how to program it at a basic level.

The next step could be to challenge them to build the slowest-moving two-motor vehicle and use the **Math – Basic** tutorial to measure the speed.

Technology / Engineering
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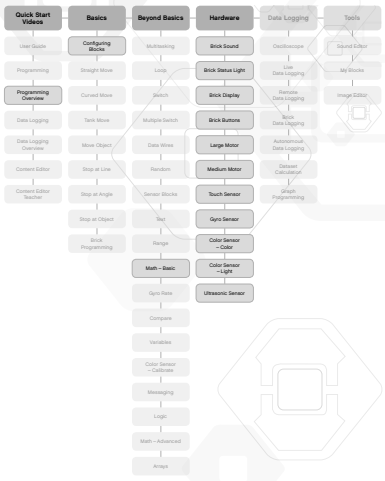

Technology / Engineering

Robot Educator Overview