In this preview, you will find an overview and highlights of the WeDo 2.0 Computing Extension Projects. The complete pack includes eight computing extension projects linked to the science projects within the core WeDo 2.0 Curriculum Pack. These projects enable pupils to learn fundamental computing and programming concepts in a real-world context.

WeDo 2.0 is designed for Key Stage 2. With WeDo 2.0, your pupils will explore, create, and share their findings as they build, program, and modify projects while working collaboratively. With this innovative solution, you can boost your pupils confidence to ask questions and solve problems by putting computing skills and scientific discovery in their hands.

Use this document along with the freely downloadable software to experience how WeDo 2.0 can help you meet curriculum objectives across computing.

Download the software for free at LEGOeducation.co.uk/WeDo
LEG© Education WeDo 2.0 Computing Extension Projects

LEG© Education is pleased to present computing project for use in primary education.

These materials will help you to deliver exciting projects based around relevant technology, which will enable pupils to learn fundamental computing and programming concepts using a wider curriculum and real-word context, while expanding on the projects found in the LEGO Education WeDo 2.0 Curriculum Pack.

WeDo 2.0 supports a hands-on, minds-on learning solution that gives pupils the confidence to ask questions, the tools to find the answers, and the skills required to solve real-life problems.

Computing is an increasingly important component of the lives of pupils. Understanding how machines and computers process information is a valuable skill to develop at a young age. It is important to encourage pupils to experiment with logical ideas, and allow them to explore and question what they do not yet understand.

Computing in WeDo 2.0 brings the pupils’ creations to life, generating excitement and the desire to discover more.
Develop programming skills through projects

These computing projects are extensions to the science projects already developed in the LEGO® Education WeDo 2.0 Curriculum Pack.

To this end, the Computing Curriculum Purpose of Study will be addressed:
“A high-quality computing education equips pupils to use computational thinking and creativity to understand and change the world. Computing has deep links with mathematics, science and design and technology, and provides insights into both natural and artificial systems. The core of computing is computer science, in which pupils are taught the principles of information and computation, how digital systems work and how to put this knowledge to use through programming. Building on this knowledge and understanding, pupils are equipped to use information technology to create programs, systems and a range of content. Computing also ensures that pupils become digitally literate – able to use, and express themselves and develop their ideas through, information and communication technology – at a level suitable for the future workplace and as active participants in a digital world.”

This document consists of one activity and eight Computing Extension Projects:

• One Experimentation Activity to quickly explore programming concepts.
• Six project extensions to Guided Projects.
• Two project extensions to Open Projects.

Each Computing Extension Project could take between one and three lessons of approximately 45 minutes, depending on how you organise them. There are no references to the computing extensions in the software. All of the information is provided in this document.

Reference
National Curriculum in England: computing programmes of study: key stages 1 and 2, Department for Education.
Target Group

The material is aimed at Key Stage 2 but can be adapted for any primary school year group. Whilst the material has primarily been written to address the computing curriculum, the projects draw on the science and geography concepts introduced in the LEGO® Education WeDo 2.0 Curriculum Pack, and the focus has been directed to investigating, modelling, and designing using programming.

These computing Extension Projects are designed to develop pupil understanding and programming skills, and to demonstrate the importance of computational thinking and the effective use of technology in everyday life. Pupils will gain experience in basic programming through a combination of direct teaching, experimentation, and exploration. These ample cross-curricular opportunities mean that the Extension Projects can be delivered contextually and will impact on other subject areas.

Important elements to consider before you start:  
• The teacher’s guide and resources will reduce planning time, and the experience gained will help you when making further plans.  
• Each Extension Project is composed of different tasks that can be used as a differentiation tool.  
• Allow each pupil to follow the progression route, as they will progressively develop their programming skills.  
• Specific skills and concepts are addressed in the teacher’s guide provided for each Extension Project.  
• The sharing aspect will also impact on pupils’ oral communication skills.
Carrying out the Experimentation Activity

The Experimentation Activity takes the form of an open-ended problem-solving task. Pupils will become familiar with the WeDo 2.0 LEGO® elements, and develop an understanding of the programming software. There will be opportunities for them to record and share their work using the built-in facilities of the software.

The focus of this activity is on exciting and engaging the pupils, and on communicating the fact that everyone can program a motor to move and a light to blink. Let the pupils discover a wide range of solutions to the task. Each different solution should be celebrated as being correct and unique.

Suggestion

In addition to the Experimentation Activity, the Getting Started Project “Milo the Science Rover” can be used to introduce pupils to WeDo 2.0. This project has been designed to guide pupils through most of the possibilities of the bricks and software. By completing the four parts of this Getting Started Project, pupils will gain experience with:

- Building to plan
- Connecting the Smarthub to their devices
- Controlling the motor through simple programming
- Controlling the motion sensor through simple programming
- Controlling the tilt sensor through simple programming
- Using different outputs such as light, sound, and images through simple programming
- Documenting their work
Using the Guided Projects extensions

There are six Guided Project computing extensions contained in this document:

They are:

• Speed Control (an extension of Speed)
• Dancing Bees (an extension of Plants and Pollinators)
• Debug the Floodgate (an extension of Prevent Flooding)
• Fearless Frog (an extension of the Frog’s Metamorphosis and Predator and Prey ‘Open Projects’)
• Rescue Count (an extension of Drop and Rescue)
• Reverse and Recycle (an extension of Sort to Recycle)

They use the same basic models and themes as the original projects, but the focus moves to developing programming skills through further modelling or designing.

Each Extension Project contains two to three tasks that gradually increase in difficulty and complexity. They can be undertaken together or separately, thereby offering opportunities for differentiation.

While pupils should be encouraged to find and record their own solutions to the tasks, the project extension chapters do contain suggested programming solutions and concepts to focus on. Where models need to be modified, detailed images of suggested modifications are provided.

Using the Open Project Extensions

There are two Open Project computing extensions contained in this document:

• Smart Lift (an extension of Moving Materials)
• Working Rover (an extension of Space Exploration)

These Extension Projects follow the same structure as the Guided Project extensions, but are more “open”, thus providing customisation opportunities.

Suggestions for programming solutions are not provided in these project extension chapters, as each pupil is expected to design and build their own unique model. However, links to the Design Library of the LEGO® Education WeDo 2.0 Software have been provided. Here, pupils will find inspiration for creating models with particular functions.
The Computing Curriculum for Key Stages 1 to 4 in England has a much stronger emphasis on programming and coding than ever before.

With this in mind, this document is designed to help teachers and pupils in meeting these new requirements using LEGO Education WeDo 2.0.
Computing Curriculum Links

This material is aimed at Key Stage 2 but can be adapted for any primary school year group.

The National Curriculum in England Computing Programme of Study aims to ensure that all pupils:

- can understand and apply the fundamental principles and concepts of computer science, including abstraction, logic, algorithms, and data representation.
- can analyse problems in computational terms, and have repeated practical experience of writing computer programs in order to solve such problems.
- can evaluate and apply information technology, including new or unfamiliar technologies, analytically to solve problems.
- are responsible, competent, confident, and creative users of information and communication technology.

To reach those goals, the LEGO® Education Computing Extension Projects have developed direct links to the requirements of the Computing Curriculum at Key Stage 2.

Using these materials, pupils will develop their skills and an understanding of these requirements.

Pupils should be taught to:

- design, write, and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts.
- use sequence, selection, and repetition in programs; work with variables and various forms of input and output.
- use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and problems.
- use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content.
- select, use, and combine a variety of software (including Internet services) on a range of digital devices to design and create a range of programs, systems, and content that accomplish given goals, including collecting, analysing, evaluating, and presenting data and information.
- use technology safely, respectfully and responsibly; recognise acceptable/unacceptable behaviour; identify a range of ways to report concerns about content and contact.
- understand computer networks including the Internet; how they can provide multiple services, such as the World Wide Web; and the opportunities they offer for communication and collaboration.
Visual overview of the Extension Projects

1. Speed Control
This project is about designing programs that will help a race car driver to determine and control the speed of a race car.

2. Fearless Frog
This project is about modelling a frog that can recognise, and escape from, dangerous predators.

3. Dancing Bees
This project is about modelling the dance of a bee that communicates the distance and location of pollen-bearing flowers, and how to return to the hive after foraging.

4. Debug the Floodgate
This project is about designing programs to correct errors in the way a floodgate is working.

5. Rescue Count
This project is about designing programs that can help with counting the number of rescued animals.

6. Reverse and Recycle
This project is about designing programs to make a recycling truck safer for the driver and pedestrians.

7. Smart Lift
This project is about designing programs that will help with the atomisation of a factory warehouse.

8. Working Rover
This project is about collaborating with other groups to design and develop a multifunctional space rover for collecting soil samples.
Experimentation Activity

Rethinking Milo’s head

This activity is designed to quickly introduce your pupils to programming with WeDo 2.0 and provide a playful learning experience around computing.
Rethinking Milo’s head: What is the function of a Science Rover head?

Curriculum links and Overview

Main Learning outcomes
The nature of this activity is to introduce pupils to programming. It is a simple and effective way of encouraging pupils to freely explore programming concepts such as input/output, program strings, programming blocks, and more.

During the activity, many of the requirements of the National Curriculum may be addressed at both Key Stage 1 and Key Stage 2.

Overview
For this activity, pupils will need to have access to the WeDo 2.0 Core Set, particularly a Smarthub and motor, as they will build a head for Milo.

Adjustments required
There is no reference to this activity in the Software. Building instructions are not provided in the software. Building inspiration is provided in this document.

Keywords
The programming focus is about discovering the ways different elements of WeDo 2.0 interact with each other.

This activity could be carried out before the “Milo the Science Rover” Getting Started project from the LEGO® Education WeDo 2.0 Curriculum Pack.
Quick glance: Experimentation Activity

Preparation (20 min.)
- Read this activity so you have a good idea of what to do.
- Prepare to introduce this activity to your pupils.
- Define your expectations and theirs.
- Determine the end result of this project: Everyone should have a chance to build, program, and document.
- Make sure timing allows for expectations to be met.

Explore phase (10 min.)
- Start the activity by describing Max and Mia's situation.
- Hold a group discussion.

Create phase (20 min.)
- Ask the pupils to build a prototype of Milo Science Rover's new head.
- Let them program their model with a simple program.
- Allow the pupils time to make their own experiments and change the parameters of the program.
- Challenge them to discover new programming blocks, and to experiment with them so that they gain an understanding of their functions.

Share phase (10 min.)
Suggestions for sharing:
- Make sure your pupils take photographs during the process.
- Make sure they write their names and comments in the Documentation tool.
- Ask your pupils to export a document of this activity and to share it with their parents.

Explore phase
Max and Mia are working in their science laboratory. They are designing prototypes of a head for Milo the Science Rover that will enable it to turn and move around, and they need your help!

To start this activity, you could:
- Show different images of robots or rovers, both from the scientific world or from the fiction world;
- Engage in a discussion with the class on what should be the function of a robot head;
- Show the pupils the video or an image of Milo from the LEGO® Education WeDo 2.0 Software, or present a LEGO model of Milo.

Suggestion
Introduce them to the Smarthub and motor from the LEGO Education WeDo 2.0 Core Set. Demonstrate how to attach an axle to the motor and how to create a simple program string to power it.
Create phase

Ask the pupils to develop solutions for this task:

1. **Build and program a head that can rotate.**
   Give the pupils some time to explore the LEGO® elements in the WeDo 2.0 Core Set. Let them work in pairs and experiment with various builds and program strings, or algorithms.

**Important**
The pupils will experiment with the programming blocks (particularly the green, ‘action’ blocks). During this process they will discover, through experimentation, the function of each block:
- Ask them to make the motor speed-up and slowdown;
- Ask them to stop the motor after a given time;
- Ask them to rotate Milo's head one way, and then the other;
- Ask them to, if appropriate, explore the use of sensors.
- Ask them to change the color of the LED on the Smarthub.

Share phase

Bring the pupils together and ask them what they have discovered, and if they have any questions or queries.
- Ask the pupils to select two different builds and programming solutions that will move the head in different ways.
- Ask them to take screenshots of their program strings and photographs of their builds, and to put this information into the documentation tool.
- Ask one or two pairs to show and explain their solutions to the rest of the class.
Suggested Programming Solutions

**Suggested programming solutions for task 1**

In this program, linear programming is used.
This program will turn the motor on in one direction. The motion is unlimited as there is not a Motor Off block to stop it.

In this program, linear programming is used.
This program will turn the motor on in one direction. The motion will last for five seconds and then stop.

In this program, linear programming is used.
This program will set the motor power to five (out of 10) and turn the motor on in one direction. The motion is unlimited as there is not a Motor Off block to stop it.

In this program, linear programming is used.
This program will turn the motor in one direction for five seconds and then in the opposite direction for three seconds. It will then stop.