LEGO® Education WeDo 2.0

Introduction

WeDo 2.0

LEGO education

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The LEGO® Education community is an online community for teachers, administrators, and other professionals in education.
It is to connect and share ideas, engage in discussions, and share lesson plans and projects.
The LEGO Education community is only in English.

Introduction to WeDo 2.0

Welcome to LEGO® Education WeDo 2.0.

In this chapter, you will discover the fundamental elements needed for the journey you are about to experience.

LEGO® Education WeDo 2.0

LEGO® Education WeDo 2.0 is developed to engage and motivate elementary students' interest in learning science- and engineering-related subjects. This is done through the use of motorized LEGO® models and simple programming.

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

Students learn by asking questions and solving problems. This material does not tell students everything they need to know. Instead it makes them question what they know and explore what they do not yet understand.

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Learning through Projects

WeDo 2.0 includes a range of different projects. These projects are divided into the following types:

- A Getting Started Project in which students learn the basic functions of WeDo 2.0.
- Guided Projects, which are linked to specific curriculum standards and include step-by-step instructions for each complete project.
- Open Projects, which are linked to specific curriculum standards and provide a more open-ended learning experience.

Each of the projects is divided into four phases:

- The Explore phase, to connect students to their task
- The Create phase, to allow students to build and program
- The Test phase, to allow students time to explore
- The Share phase, to allow students to document and present their projects

Each project can last for up to three hours. Each phase is of equal importance in the project flow, but you can adjust the time you spend on each phase to suit your students' needs and the time you have available.

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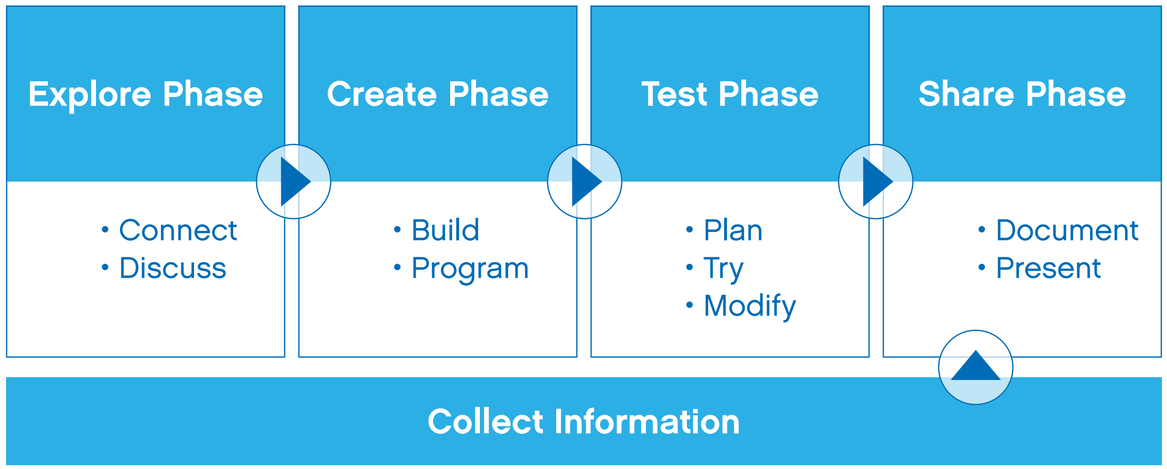
Project Progression with WeDo 2.0

WeDo 2.0 uses a project progression that is defined by four phases. These phases are explained below, and the illustration to the right shows the steps that are associated with each phase.



Explore Phase

In this phase, students connect to a scientific question or an engineering problem, establish a line of inquiry, and consider possible solutions.

Create Phase

During the Create phase, students build and program a LEGO® model.

Test Phase

In this phase, students are given tasks that will encourage them to modify their LEGO model. Each WeDo 2.0 project focuses on one of three types of activities: investigation, designing solutions, or using models. The Test phase will differ from one project to another based on the type of project that is being done.

Share Phase

During the Share phase of the project, students present and explain their solutions using their LEGO models and the findings document they have created using the integrated Documentation tool.

Important

During each of these phases, the students will use various methods to document their findings, solutions, and process. This document can be exported and used for assessment, display, or sharing with parents.

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Using the Four Phases to Plan a Teaching Sequence

There are many ways of planning a WeDo 2.0 project. As you become more experienced using the materials, you will be able to customize the time spent on each phase to fit your needs and the needs of your students.

Here are two ways in which you could use the guided project flow:

Scenario One - Condensed Lesson Flow

A condensed experience can be done in two lessons of 45 minutes each.

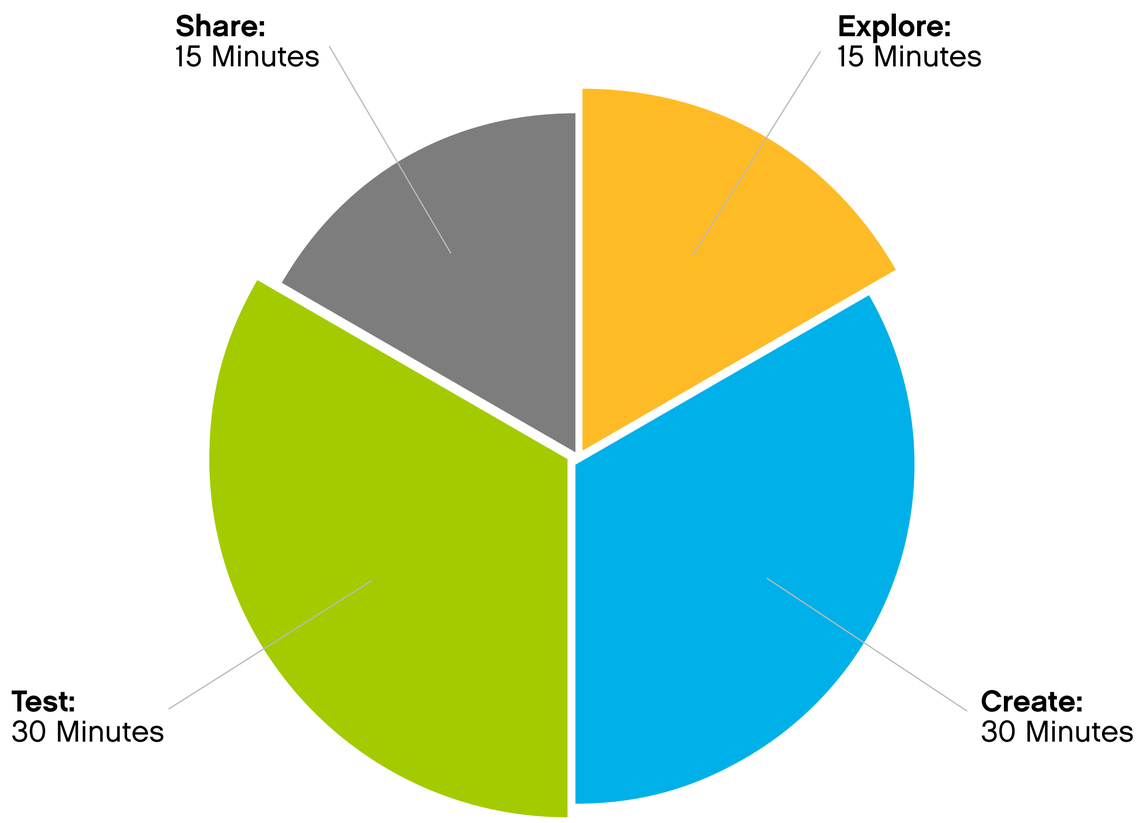
Lesson One

Explore Phase (15 Minutes): connect to the subject using the LEGO® Education WeDo 2.0 video, then have a brief discussion on the topic.

Create Phase (30 Minutes): Follow the building instructions and Programming Help to build and program the LEGO® model. Each WeDo 2.0 model takes an average of 20 minutes to build, but this can vary depending on the age and building experience of your students.

Lesson Two

Test Phase (30 Minutes): solve the tasks proposed in the flow.
Share Phase (15 Minutes): allow students time to document elements of their projects (e.g., record a video), and then share their experiences between teams.



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Using the Four Phases to Plan a Teaching Sequence

Scenario Two - Full Lesson Flow

The full lesson flow has been designed to consist of four lessons of 45 minutes each.

Lesson One

Explore Phase (45 Minutes): Deeply explore a topic by reading a story, watching the LEGO® Education WeDo 2.0 video, answering questions and having a discussion.

Lesson Two

Create Phase (25 Minutes): Follow the building instructions and Programming Help to build and program the LEGO® model. Each WeDo 2.0 model takes an average of 20 minutes to build, but this can vary depending on the age and building experience of your students.

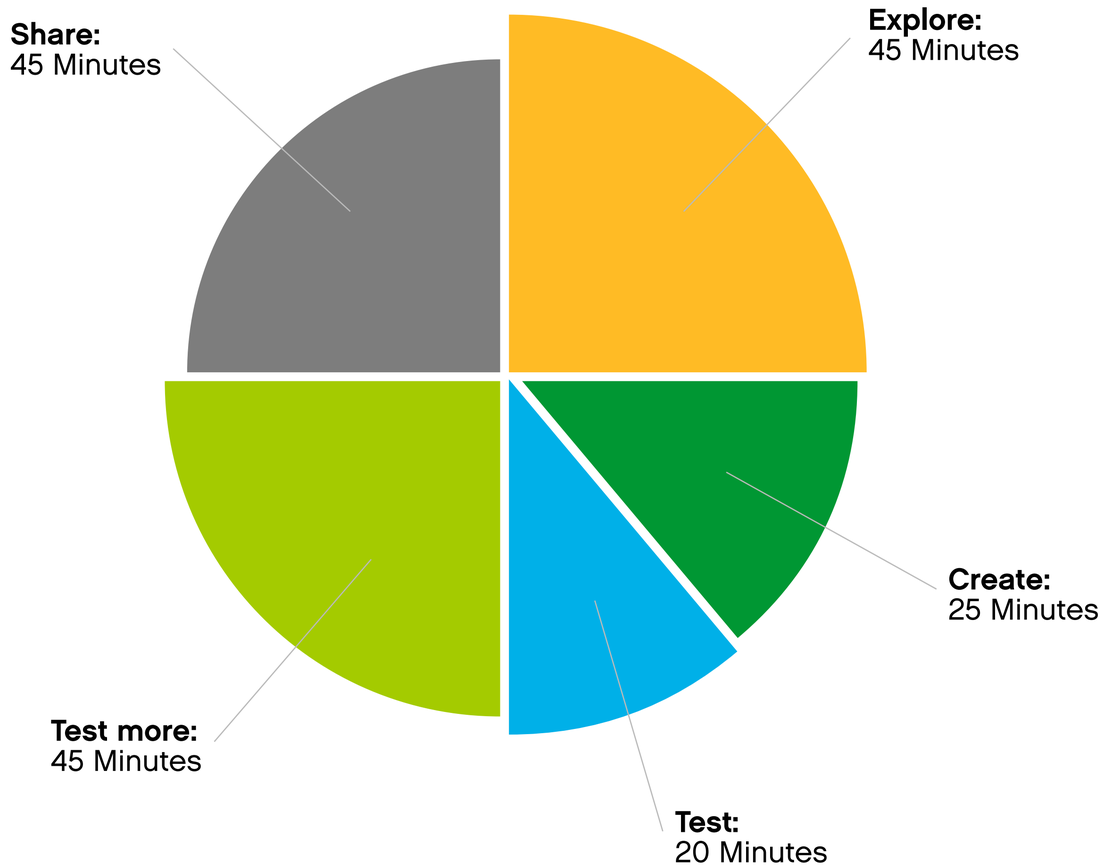
Test Phase (20 Minutes): solve the tasks proposed in the lesson flow.

Lesson Three (Optional)

Test More (45 Minutes): Solve the differentiated task proposed in the lesson flow. This task will most likely require that students rebuild a model in order to solve it. This task is always optional, but it is a good way for students to reinvest their knowledge immediately following their previous learning experience.

Lesson Four

Share Phase (45 Minutes): Allow students to share their results in a big group setting. Give each team 3 to 4 minutes to present their findings to the class.



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Using the Teacher Assistant

Some projects are equipped with the Teacher Assistant functionality. The Teacher Assistant provides material to help you in your lesson planning and during your teaching sessions.

This material includes:

- Overview of the project
- Type of project
- Curriculum links
- Planning support
- Discussion questions and answers
- Setting the scene
- Building help
- Programming Help
- Computational thinking skills development support
- Investigation skills development support
- Modeling skills development support
- Design skills development support
- Communication skills development support
- Assessment support

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Using the Getting Started Project

The Getting Started Project has been designed using a simple and progressive method to introduce students to the software features and learning experience of WeDo 2.0.

In this project, a character called “Milo” will take you and your students on a journey where you will explore places that humans cannot go in order to find a special plant specimen.

In part A, “Milo, the Science Rover,” students will:
- Engage in a discussion
- Build a LEGO® model
- Connect the Smarthub to their device
- Program a LEGO model
- Take a picture with the Capture tool
- Write in the Documentation tool

In part B, “Milo’s Motion Sensor,” students will:
- Explore ways to use the Motion Sensor
- Record a video using the Capture tool

In part C, “Milo’s Tilt Sensor,” students will:
- Explore ways to use the Tilt Sensor
- Use the Capture tool to capture an image of their program

In part D, “Collaborating,” students will:
- Use more then one Smarthub at a time
- Collaborate with other teams

A

B

C

D

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Using the Guided Projects

The Guided Projects will help you to set the scene to ensure that your students progress through a step-by-step learning experience that builds their confidence and provides the foundation necessary for them to succeed.

Each of the Guided Projects provides teacher support materials, which include:

- Curriculum links
- Detailed preparation guidance
- Assessment rubrics
- Notes regarding common student misconceptions about the subject(s)
- Guidance through the Explore, Create, Test, and Share phases of every lesson

Suggestions

It is recommended that you begin with the Getting Started Project followed by one or two Guided Projects in order to make sure that students understand the WeDo 2.0 approach and methodology.

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Using the Open Projects

The Open Projects also follow the Explore, Create, Test, and Share sequence but intentionally do not offer the same step-by-step guidance as the Guided Projects. They provide an initial brief and starting points to build upon.

The key to using the Open Projects is to make them your own; offer opportunities for projects that are locally relevant and challenging in the areas you want them to be. Use your creativity to adapt these project ideas to suit your students. You will find teacher support about Open Projects in the "Open Projects" chapter.

With every Open Projects brief, students will be given three suggested base models to look at in the Design Library.

The Design Library, located in the software, is composed of inspiration for building (Model library) and inspiration for programming (Program library). Therefore, students should not try to replicate exactly the specific model or the exact program string, but should seek for help on how to build each function, such as to lift, walk or blink. Students will find in the design library:

- Building instructions for base models
- Close up pictures for inspirational models
- Program description for base function
- Program description for inspirational functions

Important

The Design Library and Open Projects can be found in the WeDo 2.0 Software.

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Documenting Projects

Having your students document their work is one of many ways you can keep track of their work, identify where they need more help, and evaluate their progress.

Students can use many different methods to express their ideas. During the ongoing documentation process, they can:

1. Take pictures of important steps of their prototype or their final models
2. Take pictures of the team working on something important
3. Record a video explaining a problem they are facing
4. Record a video explaining their investigation
5. Write critical information within the Documentation tool
6. Find supporting pictures on the Internet
7. Take a screen capture of their program
8. Write, draw, or sketch on paper and take a photo of it

Suggestion

Depending on the age group you work with, the combination of paper and digital documentation can be the richest.

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Sharing Projects

At the end of the project, students will be excited to share their solutions and findings. It will be a great opportunity to develop their communication ability.

Here are different ways you can have your students share their work:

1. Have students create the display where the LEGO® model will be used.
2. Have students describe their investigation or diorama.
3. Have a team of students present their best solution to you, to another team, or in front of the class.
4. Have an expert (or some parents) come to your class to listen to your students.
5. Organize a science fair at your school.
6. Have students record a video to explain their project and post it online.
7. Create and display posters of the projects in your school.
8. E-mail the project document to parents or publish in student portfolios.

Suggestion

To make this experience even more positive, have students give one positive comment or ask one question about others' work when they take part in the sharing session.

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The Science Lab

Max and Mia's virtual WeDo 2.0 Science Lab is a great place for students to get connected to real-life questions or problems. You can meet them in every Guided Project.

Max is always ready for a new project. He loves to discover new topics, and he is really creative when it is time to invent something new.

Mia is thrilled by any discoveries. She is very curious about the world around her, and she always wants to know more.

In the Getting Started Project, Max and Mia are joined by Milo, the Science Rover, who is capable of great discoveries.

Max and Mia have great projects to propose and they are excited to **welcome you to the LEGO® Education WeDo 2.0 Science Lab!**

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Developing Science and Engineering Practices with WeDo 2.0

WeDo 2.0 projects will develop science practices. They provide opportunities for students to work with and develop ideas and knowledge as well as an understanding of the world around them.

The progression and difficulty level in the projects allow students to develop competency while exploring and learning about key science topics. The projects have been carefully chosen to cover a wide variety of topics and issues.

WeDo 2.0 projects develop eight science and engineering practices:

1. Ask questions and solve problems
2. Use models
3. Design prototypes
4. Investigate
5. Analyze and interpret data
6. Use computational thinking
7. Engage in argument from evidence
8. Obtain, evaluate, and communicate information

The guiding principle is that every student should engage in all of these practices across the projects in each grade.

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Developing Science and Engineering Practices with WeDo 2.0

The science and engineering practices serve as the common thread throughout the curriculum, and all standards should, in essence, be taught through them. While the academic definition of each process is important, it is probably a good habit to verbalize the practices in a way that is understandable to students at that level.

The following identifies the basic principles of these practices and gives examples on how they are used in WeDo 2.0 projects.

1. Ask questions and define problems
This practice focuses on simplistic problems and questions based upon observational skills.

2. Develop and use models
This practice focuses upon students' prior experiences and the use of concrete events in modeling solutions to problems. It also includes improving models and new ideas about a real-world problem and solution.

3. Plan and carry out investigations
This practice is about how students engage in an investigation process to formulate probable solution ideas and to test these ideas.

4. Analyze and interpret data
The focus of this practice is to learn ways to gather information from experiences, document discoveries, and share ideas from the learning process.

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Developing Science and Engineering Practices with WeDo 2.0

5. Use mathematics and computational thinking
The purpose of this practice is to realize the role of numbers in data-gathering processes. Students read and gather data about investigations, make charts, and draw diagrams resulting from the numerical data. They add simple data sets to come up with conclusions. They understand or create simple algorithms.

6. Construct explanations and design solutions
This practice is about ways they might go about constructing an explanation or designing a solution for a problem.

7. Engage in argument from evidence
Constructively share ideas based upon evidence that it is an important feature of science and engineering. This practice is about how students begin to share their ideas and demonstrate evidence to others in a group.

8. Obtain, evaluate, and communicate information
Teaching children what real scientists do is key to this practice. The way in which they set up and complete investigations to gather information, how they evaluate their findings, and how they document are all important elements. It is important that teachers explore a plethora of ways to have students gather, record, evaluate, and communicate their findings. Ideas include digital presentations, portfolios, drawings, discussion, video, and interactive notebooks.

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Developing Computational Thinking Practices with WeDo 2.0

Computational thinking refers to a set of skills that are used in various fields and situations, and in our daily lives. These skills are not only associated with the field of computer science field and they're not intended to make people think like computers. The skills associated with computational thinking can help us to solve problems.

WeDo 2.0 develops students' computational thinking skills in the following ways:

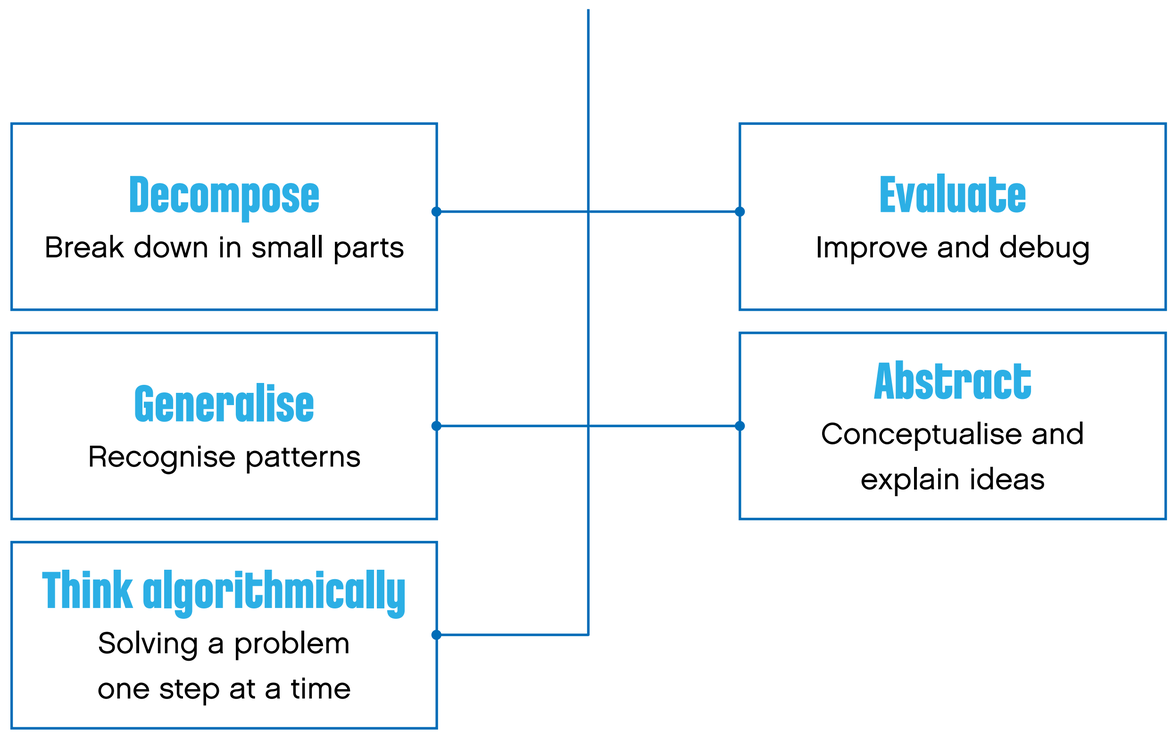
Decomposition
Students will learn how to break down a problem into smaller parts in order to ease the process of finding a solution.

Generalization (Pattern Recognition)
Students will practice recognizing the parts of a task that are known or have been seen somewhere else.

Algorithmic Thinking
Students will define a sequence of steps for solving a problem. Creating and ordering these steps in a computing context often refers to the idea of coding or programming.

Evaluating
Students will evaluate whether of not their prototype works in the way they intended. If not, they will identify what needs to be improved.

Abstraction
Students will explain their solution with a sufficient level of detail, while omitting the unimportant details.



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Using the LEGO® Bricks in a Scientific Context

LEGO® bricks have been used in three different ways in the WeDo 2.0 projects:
1. To model reality
2. To investigate
3. To design

These three ways will give you the opportunity to develop a different set of practices, as the outcome of the project is different in each case.

1. Use models
Students represent and describe their ideas using the bricks.

Students can build a model to gather evidence or provide a simulation. Although only representations of reality, models enhance understanding and explain natural phenomena.

When implementing a modeling project, encourage students to focus their creativity on representing the reality as accurately as possible. By doing that, they will need to identify and explain the limitations of their models.

Examples of modeling Guided Projects are:
- Frog's Metamorphosis
- Plants and Pollinators

2. Investigate
Planning and carrying out investigations is an ideal framework for a science project. Students' learning is enhanced by active engagement with the problem. Students are encouraged to make predictions, carry out tests, collect data and draw conclusions.

When implementing an investigation project, you should encourage students to pay special attention to ensure fair testing. Ask them to search for cause and effect in their tests, ensuring they change only one variable at a time.

Examples of investigating Guided Projects are:
- Pulling
- Speed
- Robust Structures

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Using the LEGO® Bricks in an Engineering Context

3. Design
Students design solutions for a problem for which there is no single answer. The problem may require students to design a combination of plans, models, simulations, programs, and presentations. Going through the design process will require students to constantly adjust and modify their solutions to meet criteria.

While designing a solution, it will be important to recognize that the idea of "failure" in engineering is a sign of growth in the cognitive process. Therefore, students may not get a viable solution on the first try or within the provided time constraints. In that case, have them reflect on their process to identify what they have learned.

When you implement a design project, encourage students to focus their creativity on designing multiple solutions. Ask them to select the prototype they think is the best according to the criteria you have set.

Examples of designing Guided Projects are:

- Prevent Flooding
- Drop and Rescue
- Sort to Recycle

Important

Documents produced by students following the completion of these three types of projects may contain different types of information.

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Using LEGO® Bricks in a Computational Thinking Context

WeDo 2.0 will introduce your students to icon-based programming. In every project, your students will find that part of their solution lies in finding the right sequence of actions for activating motors and using sensors.

In doing this, they will learn that solutions can be found both by improving the way their model is built and by improving way they have programmed it. This mindset is called “computational thinking” and it is a set of skills that everyone can use to solve problems.

WeDo 2.0 gives students the opportunity to develop their computational thinking skills using the engineering design process.

Examples of computational thinking-related Guided Projects:

- Moon Base
- Grabbing Objects
- Send Messages
- Volcano Alers

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Assess with WeDo 2.0

There are many ways you can monitor and assess your students' progress through a WeDo 2.0 project, including:

- Anecdotal record grid
- Observation rubrics grid
- Documentation pages
- Self-assessment statements

Providing Feedback to Students

Developing students' science, engineering, and computational thinking skills takes time and requires ongoing feedback. Just like in the design cycle, in which students should know that failure is part of the process, assessment should provide feedback to students in terms of what they did well and where they can improve.

Problem-based learning is not about succeeding or failing. It is about being an active learner and continually building upon and testing ideas.

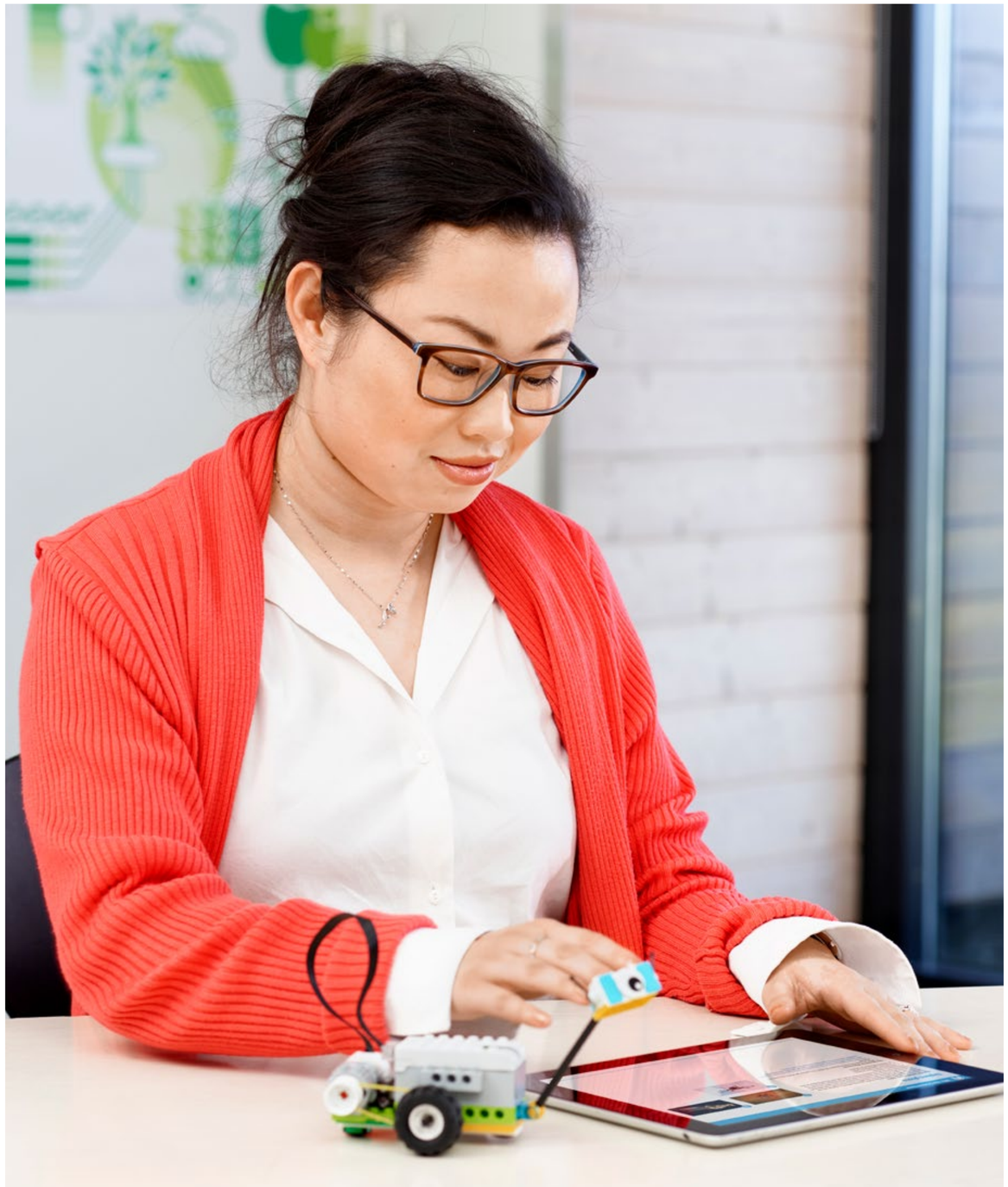
Giving feedback to students in order to help them develop their skills can be done in various ways. For example, at each phase of a WeDo 2.0 project, you could use the provided rubrics as guidance while:

- Observing each student's behavior, reaction, and strategies
- Asking questions about their thought processes

Since students often work in groups, it can be helpful to give feedback both on a team level and on an individual level.

Important

You will find the assessment rubrics in the "Assessment" chapter of the curriculum pack document, which can be found within the WeDo 2.0 software.



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Classroom Management

In this chapter, you will find information and guidance to ease the implementation of WeDo 2.0 in your classroom.

The secret for success resides in some key elements:

- Good material preparation
- Good classroom disposition
- Good WeDo 2.0 project preparation
- Good guidance of students

Preparing the Material

Before Using WeDo 2.0 with Your Students

1. Install the WeDo 2.0 software on your computers or tablets.
2. Open each LEGO® Education WeDo 2.0 core set and sort the elements.
3. Attach the labels to the relevant compartments in the sorting tray.
4. You may want to identify and label the box, Smarthub, motor, and sensors with a number. That way, you can sign out a numbered kit to each student or team. You may find it helpful to display the parts list in your classroom.
5. Insert two AA batteries into the Smarthub or use the supplementary Smarthub Rechargeable Battery.

Suggestion

To improve your classroom experience, it is strongly recommended that you give a unique name to each Smarthub. This can be done from the Connection Center of the WeDo 2.0 software.

To Rename a Smarthub

From the WeDo 2.0 software, access the Connection Center:

1. Press the green button on the Smarthub.
2. Press the Smarthub name in the list to connect to it.
3. Long press on the connected Smarthub name you want to change.
4. At this point, you will be able to enter a new name for the Smarthub (e.g., A, B, etc.). By doing this, it will be easier for your students to connect to the right Smarthub.

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Before Starting a Project

Teacher Preparation

1. Read the overview and project description, and select some projects you wish to do.
2. Spend some time reading about the project, understanding the flow, and exploring the teacher help that is provided.
3. Spend some time exploring the bricks in the set, and decide on a few key expectations to determine how you will use the WeDo 2.0 materials in class.
4. Set aside an hour and try the Getting Started Project as if you were a student.
5. Before going to class, review your plan for the project you have selected.

Classroom Preparation

1. Organize a cabinet, a wheeled cart, or other space in which to store the sets between lessons.
2. If it is not already available in your classroom, prepare a box of measuring tools, including rulers or measuring tapes and paper, for collecting data and making charts.
3. Ensure there is enough space in your classroom for the students to work on their projects.
4. When planning the projects, ensure that there is enough time for the students to store their models or put the parts back in the box at the end of the lesson.

Now you are good to go!

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Student Guidance

It is important to establish good classroom management habits when working with the WeDo 2.0 sets and digital devices.

It may be helpful to establish clear expectations for team roles:

- WeDo 2.0 projects are optimal for a team of two students working together.
- Have students work to their strengths in their groups.
- Make adjustments for challenging teams who are ready to develop new skills and improve further.
- Assign or have students determine specific roles for each team member.

Suggestion

Assign a role to each student so the team can foster collaboration and cooperation skills. Here are some roles you could use:

- Builder, brick picker
- Builder, brick assembler
- Programmer, creating the program strings
- Documenter, taking photos and videos
- Presenter, explaining the project
- Team captain

It is also a good idea to rotate roles, to let every student experience all components of the project, and, therefore, get the chance to develop a range of skills.

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