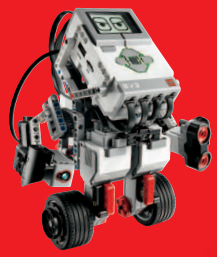
# Create critical thinkers



## Middle School

Building and Shaping lifelong learners

LEGO® Education in Middle School is focused on helping teachers making students become critical thinkers with the skills needed for a digital future.

Building on a hands-on approach, we provide strong teaching solutions that create and support student engagement within Science, Technology, Engineering and Math (STEM). All our solutions are developed with a focus on Real-life application, thereby helping the teacher to make the students realise and understand the value of STEM skills all while they are teached in accordance with local Curriculum targets as well as build their 21st century skills like:

**Collaboration**
**Communication**
**Creativity**
**Critical thinking**
**Problem-solving**

So let's together create the critical thinkers of tomorrow.

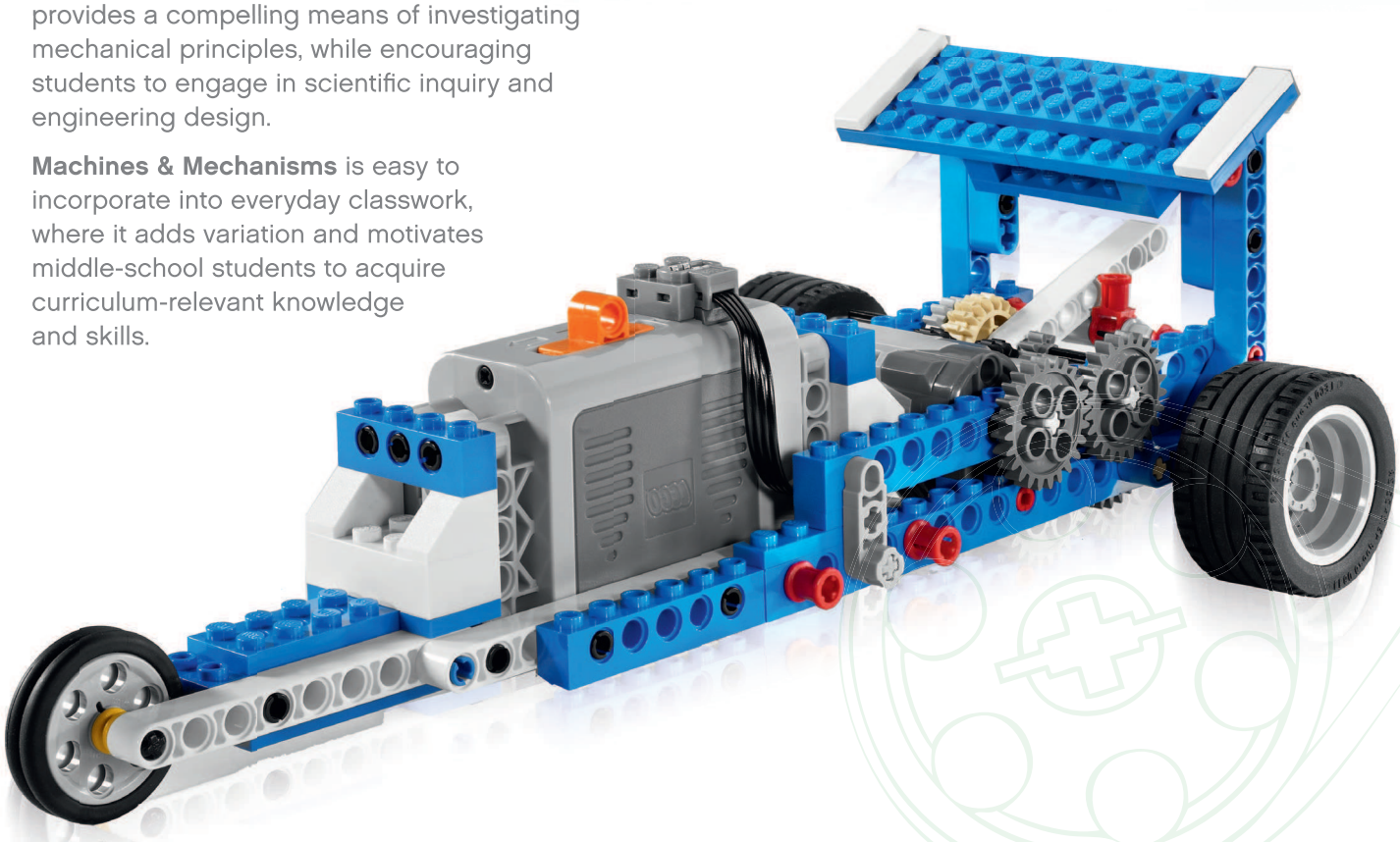
education

# "WOW!
## So that's how the real world works with Machines and Mechanisms"

**Machines & Mechanisms** from LEGO® Education is a range of challenging hands-on tools that link book-learning in science, technology, engineering and math to real-world phenomena.

Using specially compiled LEGO® elements to cover advanced topics like pneumatics and renewable energy, **Machines & Mechanisms** provides a compelling means of investigating mechanical principles, while encouraging students to engage in scientific inquiry and engineering design.

**Machines & Mechanisms** is easy to incorporate into everyday classwork, where it adds variation and motivates middle-school students to acquire curriculum-relevant knowledge and skills.



# Simple & Powered Machines

**Simple & Powered Machines** Curriculum Pack and building set provide comprehensive materials that start with the principled behind all six simple machines, then add complex mechanisms such as gears and cams. Topics cover concepts in forces and motion, measuring, energy and structures.

The activities progress to more challenging applications using machines powered with a motor. Students ask relevant scientific and technical questions, reflect on what they observe, discuss their results, formulate conclusions based on evidence and communicate with their fellow student scientists and engineers.


Replacement Pack Available
See page 83

## Simple & Powered Machines Set

9686 | 1-3 | 396 | www | 8+ yrs

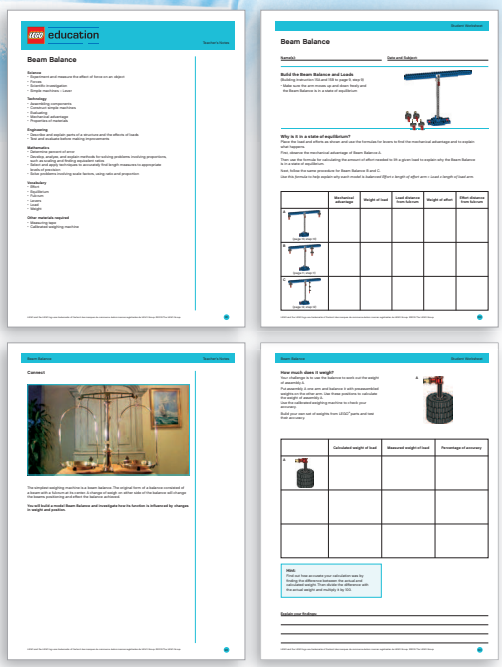
The core brick set in our range of Machines & Mechanisms solutions, this set includes full-color building instruction booklets for 10 principle models and 18 main models. Combine with curricular-relevant activity packs and add-on sets to carry out a broad range of activities within design technology, science and mathematics.

## Key learning values

- Building and exploring real life Machines and Mechanisms
- Investigating powered machines with the motor
- Using plastic sheets for calibration and capturing wind
- Exploring gearing mechanisms with the assorted gear wheels incl. differential

# Advancing with Simple & Powered Machines

Building on already acquired skills, **Advancing with Simple & Powered Machines** from LEGO® Education gives students in grades 5–7 a more in-depth understanding of how simple machines and mechanisms work, while helping them further investigate concepts such as forces, motion, measuring and energy.


## Advancing with Simple & Powered Machines

2009687 www 10+ yrs

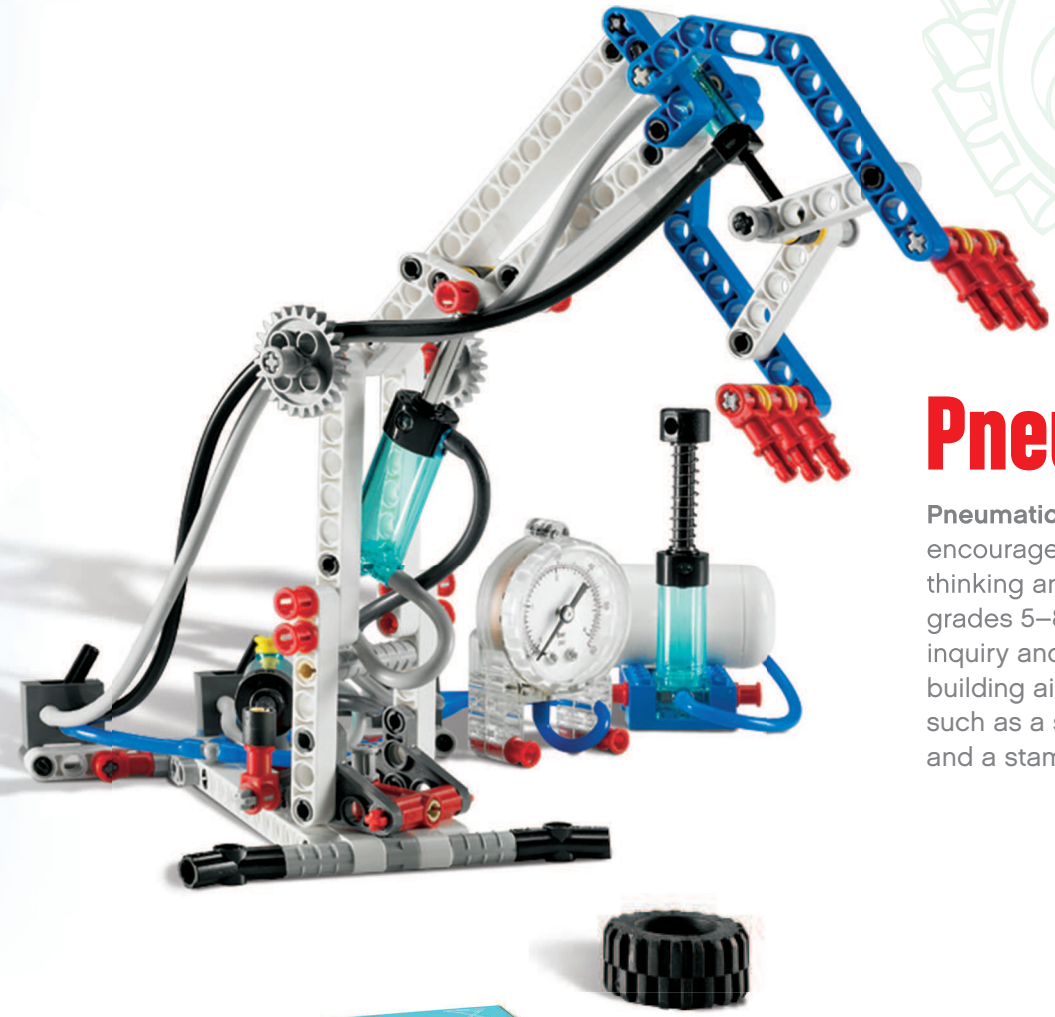
A comprehensive activity pack that includes 37 models for exploring principle concepts, 14 investigation activities and six problem solving design engineering activities. Each main and problem solving activity is best with two classes. Total: 40 classes (45 minutes each). The principal models include reference materials and quick activities. Plan an additional six to eight classes (45 minutes each) for each model.

## Key learning values

- Investigating the principles of simple machines, mechanisms and structures
- Mechanical advantage
- Balanced and unbalanced forces
- Equilibrium
- Block and tackle
- Effect of force on an object
- Experimenting with friction
- Calculating speed, distance, time and weight
- Identifying dependent and independent variables



Colors of and decorative designs on elements may vary.



# Pneumatics

**Pneumatics** from LEGO® Education encourages logical and creative thinking and motivates students in grades 5–8 to engage in scientific inquiry and engineering design by building air-powered LEGO® models such as a scissor lift, a robotic hand and a stamping press.


## Pneumatics Add-on Set

9641 | 31 | WWW | 10+ yrs

The Pneumatics Add-on Set for the 9686 Base Set provides five principle models and four real-life pneumatics models. Includes full-color building instructions, pumps, tubes, cylinders, valves, air tank and a manometer. Combine with the 2009641 activity pack to carry out 14 principle model activities, four new lesson plans and two problem-solving tasks.

### Key learning values

- Building and exploring pneumatics through real-life LEGO® models
- Investigating power systems and components
- Pressure measuring in psi and bar
- Exploring kinetic and potential energy

## Activity Pack for 9641

2009641 | WWW | 10+ yrs

Includes 14 models for exploring principal concepts, four main activities and two problem solving activities. Each main activity and problem solving activity is best with two classes.

Total: 12 classes (45 minutes each). The principal models come with reference materials and quick activities. However, if you choose to spend a set number of classes on all of the principles, plan an additional two classes (45 minutes each).

### Key learning values

- Building and exploring pneumatics through real-life LEGO® models
- Exploring sequence and control
- Engaging students in engineering and design
- Using measures and data analysis to describe and explain outcomes

LEGO education

# Renewable Energy

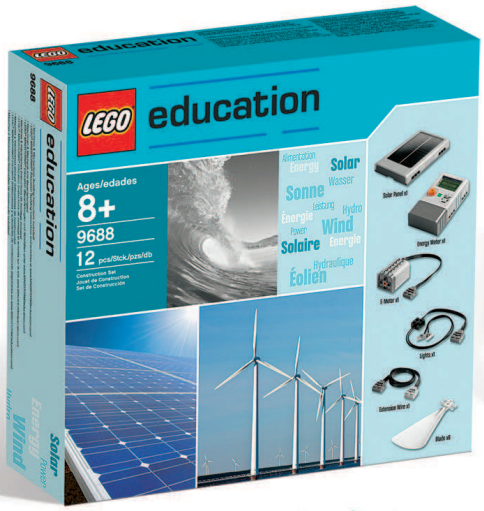
Consisting of a Simple & Powered Machines set, a Renewable Add-On Set and a special Activity Pack, **Renewable Energy** from LEGO® Education helps students in grades 5–8 explore solar, wind and water energy, plus meet curriculum goals in science, technology and engineering, by building their own real-life models.

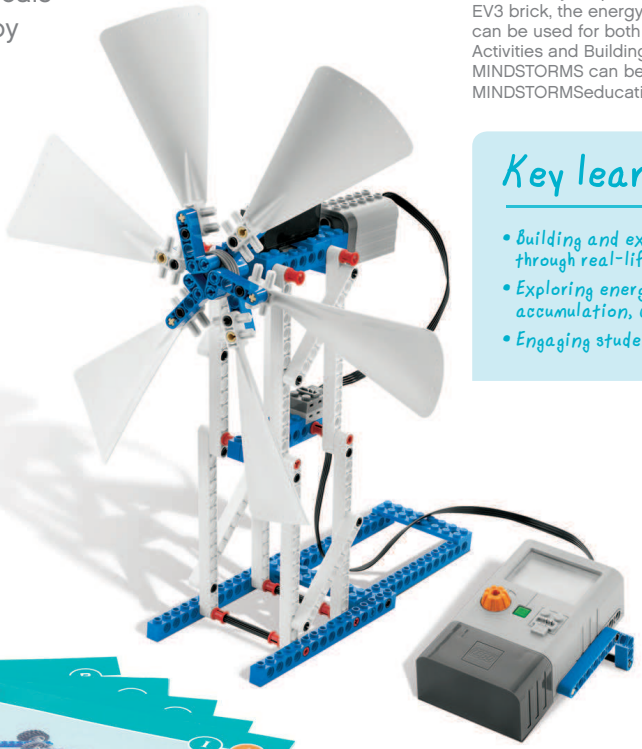
Compatible for both NXT and EV3

## Renewable Energy Add-on Set

9688 | 12 | www | 8+ yrs

This exciting add-on set allows students to learn about renewable energy sources and can be used with the Simple & Powered Machines Set (9686) and LEGO® MINDSTORMS® Education (45544). The set includes a solar panel, turbine blades, a motor/generator, LED lights, an extension wire, a LEGO Energy Meter and full-color building instructions for six real-life LEGO models to build with 9686. Add the Renewable Energy Activity Pack (2009688) for detailed lesson plans to cover solar, wind and hydro power. Connected to the MINDSTORMS EV3 brick, the energy meter works as a sensor and can be used for both programming and data logging. Activities and Building instructions for using 9688 with MINDSTORMS can be downloaded free of charge at MINDSTORMSeducation.com.



### Key learning values

- Building and exploring renewable energy through real-life LEGO® models
- Exploring energy supply, transfer, accumulation, conversion and consumption
- Engaging students in engineering and design

## Activity Pack for Renewable Energy Add-on Set

2009688 | www | 10+ yrs

This activity pack provides six 45-minute lessons and four problem-solving activities that allow students to explore the three major renewable energy sources, solar, wind and water, through real-life LEGO® models. Includes a wide range of real-life images, ideal for introducing them to the topic and task at hand. Teacher's notes, student worksheets and glossary included.

### Key learning values

- Exploring renewable energy sources
- Investigating energy supply, transfer, accumulation, conversion and consumption
- Using measurements and data analysis to describe and explain outcomes




Colors of and decorative designs on elements may vary.

# Classroom Solutions

## RENEWABLE ENERGY

Classroom Set 2 students

1 x 9688
Renewable Energy Add-on Set

ADD-ON to 9686

1 x 2009688
Activity Pack for Renewable Energy Add-on Set

Classroom Set 30 students

15 x 9688
Renewable Energy Add-on Set

1 x 2009688
Activity Pack for Renewable Energy Add-on Set

## PNEUMATICS

Classroom Set 2 students

1 x 9641
Pneumatics Add-on Set

ADD-ON to 9686

1 x 2009641
Activity Pack for 9641

Classroom Set 30 students

15 x 9641
Pneumatics Add-on Set

1 x 2009641
Activity Pack for 9641

# ENERGY ELEMENTS

## Energy Display

9668 8+ yrs

This element displays input and output in volts, watts, amps, and energy storage level in joules. Combine with 9669 Energy Storage to form the LEGO® Energy Meter.

## Energy Storage

9669 8+ yrs

This Ni-MH battery with connector is designed to be combined with the 9668 Energy Display. When combined, the two elements form the LEGO® Energy Meter. Storage capacity: 150 mAh.

## E-Motor

9670 7+ yrs

The E-Motor is a 9V motor with an internal gearbox. Its 9.5:1 gearing ratio provides a maximum torque of 4.5 Ncm and approximately 800 rotations per minute without load. It also functions as a very efficient generator.

## LEGO® Solar Panel

9667 8+ yrs

The Solar Panel provides sufficient power to operate the LEGO® Energy Meter and motors. It delivers: 5V, 4mA in direct light from a 60W incandescent bulb positioned 25 cm from the solar panel (>2000 lux); and 5V, 20mA in direct light from a 60W incandescent bulb positioned 8cm from the panel (>10,000 lux).

## Power Functions Battery Box

8881 7+ yrs

Give even more power and movement to your models with an extra battery box to supply power to your Power Functions motors! Each battery box can power 2 XL-Motors or 4 M-Motors at the same time. Requires 6 AA (1,5V) batteries, not included.

## Power Functions Light

8870 7+ yrs

Add bright LED lights to your models to create glowing eyes, illuminated headlights, and anything else you can imagine and build.

# POWER FUNCTIONS

## Power Functions M-Motor

8883 7+ yrs

Build an extra medium-strength, medium-sized M-Motor into your LEGO® creations and watch things start moving.

## Power Functions XL-Motor

8882 7+ yrs

Add an extra XL-Motor to your models! This super-strong motor will give plenty of power to your models, whether it's spinning a wheel or turning a system of gears. Use the "M" Motor to animate larger builds. Requires battery box (Item 8881), not included.

## Power Functions Extension Wire 20"

8871 7+ yrs

Build your Power Functions-equipped models bigger, better and more mechanized and motorized than ever before by adding this 20-inch (50 cm) extension wire.

## Power Functions Extension Wire 8"

8886 7+ yrs

Build your Power Functions-equipped models bigger, better and more mechanized and motorized by adding this 8-inch (20 cm) extension wire.

## Transformer 10V DC

8887 8+ yrs

This standard 10V DC transformer allows you to recharge your 9693 Rechargeable Battery DC or 8878 Power Functions Rechargeable Battery Box.

## Power Functions Rechargeable Battery Box

8878 7+ yrs

This rechargeable battery box has built-in Lithium polymer batteries for low weight and maximum power.

Use the 8887 10VDC LEGO® Transformer to charge the battery.

- Motor speed can be controlled via the battery box speed control dial!
- Output voltage is 7.4V.

# LEGO® Education – express and reflect on the world around you

BuildToExpress is a unique tool helping you to ignite all your students to reflect and express on their world around them but also to reflect and understand challenging and tricky curriculum related topics. They may use the concept to discuss a novel, to prepare for a design challenge or to debate for instance democracy.

BuildToExpress is a method for addressing virtually any curriculum subjects and learning outcome. Educators can use the tool to tailor their lesson plans.

## BuildToExpress Core Set

45110 1-6 200 6+ yrs

The set includes over 200 LEGO® elements in a separate storage unit. They have been carefully selected to provide a broad spectrum of "ready-made metaphors". The colorful bricks, accessories and Minifigures inspire students and stimulate their creative thinking and imagination.

Reflection
DIALOGUE
LISTENING
speaking
Reflection


# BuildToExpress Guide & Activity Pack

2045110 www 6+ yrs

Contains practical guidance on introducing and working with the BuildToExpress concept. Enables you to hear other teachers' experiences, and includes 30 age-segmented, core-curriculum-based Build & Share Challenge Cards as well as plenty of ready-prepared activities for you to work with.

## Key learning values

- BuildToExpress encourages reflection and gives students the opportunity to express on the world around them
- BuildToExpress develop and strengthens 21st century skills enabling students to communicate more effectively, enhancing creativity and their critical-thinking ability
- BuildToExpress promotes a cooperative learning environment and gives all students an equal voice



# BUILDTOEXPRESS

## Classroom Solutions

### Classroom Set 2-3 students

2-3 x 45110
BuildToExpress Core Set

1 x 2045110
BuildToExpress Guide & Activity Pack

### Classroom Set 24 students

24 x 45110
BuildToExpress Core Set

1 x 2045110
BuildToExpress Guide & Activity Pack



Colors of and decorative designs on elements may vary.