Introduction

LEGO® Education is pleased to bring you '2009686 Introducing Simple & Powered Machines'.

Who is it for?

The material is designed for use by non-specialist teachers of key stage 2 and lower 3. Working in pairs, children of any academic background from eight years and up can build, investigate and learn from the models.

Check the grid in the curriculum section to see which themes match your current teaching program.

What is it for?

The 'Introducing Simple & Powered Machines' activity pack enables children to work as young scientists, engineers and designers providing them with settings, tools and tasks that promote design technology, science and mathematics.

Using our activity pack children are encouraged to involve themselves in real world investigations and problem-solving. They make assumptions and predictions. They design and make models and then observe the behaviour of these models; they reflect and re-design, and then record and present their findings.

The 'Introducing Simple & Powered Machines' activity pack enables teachers to cover the following overall curriculum skills:

- Think creatively to try to explain how things work
- Establish links between cause and effect
- Design and make artefacts that fulfil specific criteria
- Try out ideas using results from observations and measurements
- Ask questions that can be investigated scientifically
- Reflect on how to find answers also imagining new possibilities
- Think about what might happen, or try things out
- Make fair tests by changing single factors and observing or measuring the effects
- Make systematic observations and measurements
- Display and communicate data using diagrams, drawings, tables, bar charts and line graphs
- Decide whether conclusions agree with any predictions made, and whether they enable further predictions
- Review work and describe its significance and limitations

What is it and how to use it?

The 9686 building set

The set has 396 elements, including a motor, and Building Instructions booklets for 14 main models and for 37 Principle Models – all in full colour. Some of the Building Instructions booklets are intended for use with other LEGO® Education activity packs.

Included is also a sorting tray and accompanying element overview showing all the different elements in the set. Everything is stored in a sturdy blue storage box with a transparent lid.

Building Instructions booklets

We have devised the Buddy Building system in which models are designed so two children can build simultaneously – also saving time. Each child (Buddy) builds his or her own subsystems using separate booklets (A and B). Working in pairs the subsystems are then built together to become one complete model.

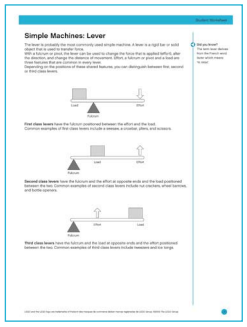
Further progression for both children is suggested in booklet B in red number sequences.

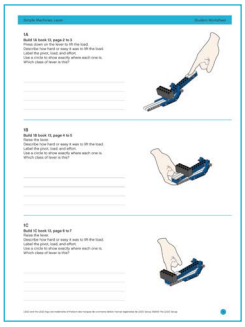
Principle Models

The Principle Models let children experience the mechanical and structural principles normally hidden away inside everyday machines and structures. The many easy-to-build models each present a hands-on demonstration of one of the concepts of simple machines, mechanisms and structures in a clear, straight-forward manner.

By progressing sequentially through the activities, using the Student Worksheets and Building Instructions, children will experience and discover the principles at work and be challenged to apply their knowledge when recording their results. In the Teacher's Notes you will find suggested answers to the questions posed in the Student Worksheets.

The Principle Models are a pathway for children to understand and integrate mechanical and structural principles applied in their own models.

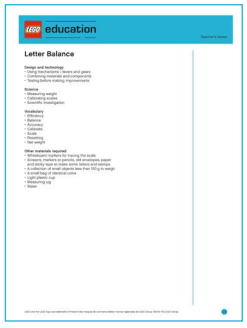


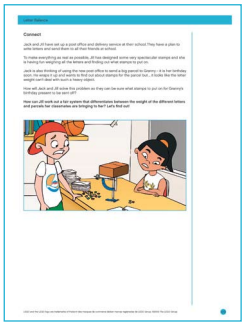


Teacher's Notes

In the Teacher's Notes you will find all the information, tips and clues you need to set up a lesson. Each model the children build has specific key learning focus areas, vocabulary, questions and answers, and further ideas for investigations.

The lessons follow LEGO Education's 4C approach; Connect, Construct, Contemplate and Continue. This enables you to progress naturally through the activities.

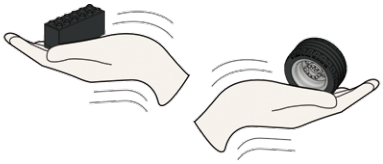




Connect
You add to your brain's knowledge when you connect a new learning experience to those you already have or when an initial learning experience is the seed stimulating the growth of new knowledge. Ideas are provided for helping the children identify a problem and for helping Jack and Jill, our two cartoon friends who help guide us through the activities. Show the flash animation with Jack and Jill and have the children define the problem and investigate how best to come up with a solution. Another approach is to read the story in connection with the flash animation.

Please also draw on personal experience and from current events both near and far to set the scene for the children. The more easily the children identify with the situation in which Jack and Jill find themselves, the more easily they will come to grips with the technology, science, and mathematics embedded in them.

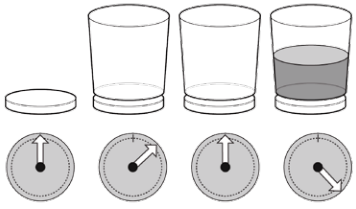
Construct
Learning is best when hands and minds are engaged. In pairs, children build models step-by-step. Two buddies each build half a model using separate booklets (A and B) to create their own subsystems and then collaborate to assemble one complete model.



Contemplate
When you contemplate what you have done, you have the opportunity to deepen your understanding. As you reflect, you develop connections between previous knowledge and new experiences. This involves children reflecting on what they have observed or constructed, and deepening their understanding of what they have experienced. They discuss their results, reflect on and adapt ideas, and this process can be encouraged by asking relevant scientific and technical questions.

Questions are included in the material to encourage children to carry out relevant investigations, predictions and rationales, and to reflect on how to find answers – also imagining new possibilities.

This phase includes the possibility to start evaluating the learning and the progress of the individual child.



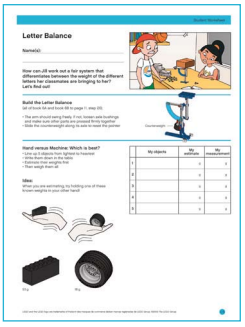
Continue
Learning is always more enjoyable and creative when it is adequately challenging. Maintaining this challenge and the pleasure of accomplishment naturally inspires the continuation of more advanced work. Therefore extension ideas are provided to encourage the children to change or add features to their models and to investigate further – always with the key learning area in mind. This phase allows the children to operate at different speeds and levels conducive to their individual capabilities.

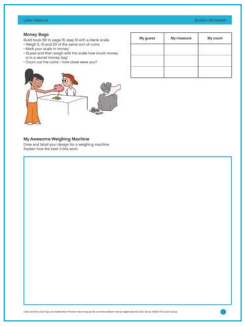
It is OK if there is too little time to complete Continue phases within the class period. Working through the first three phases of the process covers the curriculum skills listed for any one activity. You may omit the Continue phase at your discretion, or postpone it until the next lesson.

Student Worksheets
Each worksheet has a focused approach following the 4Cs and includes easy-to-read pictorial guidelines. The children can use and explore their models with little teacher assistance. They will be able to predict, try out, measure and record data, change the models to compare and contrast findings, and draw conclusions.

Let the children work in pairs, predict and test their predictions at least three times to be confident that their results are reliable. Then they record their main data accordingly. At the end of each activity, the children are challenged to design and draw a device that applies the major concepts they have just explored.

The worksheets are an easy-to-use tool for assessment of the individual child's level and achievement. They can also form a valuable part of the children's log books.





Problem-solving Activities
The six Problem-solving Activities all feature real-life settings with needs that cannot be solved in just one way.

The problem descriptions and the closely-defined design brief are meant to be copied and used by the children. Descriptions of learning focus areas, materials needed, extra challenges and how to progress is teacher information only!

The Problem-solving Activities are realistic and children will be able to test and integrate more than just one principle at a time.
The Teacher's Notes for each challenge provides tips on what and how to measure while at the same time carrying out fair testing of the solutions.

As a support we have included suggested solutions to the problems posed. Use these as 'tips and tricks', or print them and hang them as posters as inspiration for the children. The suggested problem-solving model solutions are only meant as guiding principles for any workable solution the children will come up with themselves.

Classroom management tips

Order of activities

Start out with the principles section: simple machines, mechanisms and structures. Have the children build through some or all of the basic principles to get a hands-on understanding of the concepts involved.

Then choose which theme fits your current teaching programme. You introduce the main activities within the theme and let the children investigate the ideas listed in the Teacher's Notes and in the Student Worksheets.

After each theme a relevant Problem-solving Activity may be introduced to determine how well the children can consult and apply the knowledge they have gained.

How much time do I need?

A double lesson is ideal to be able to explore, build and test in depth all the extension ideas built into the material and for the children to make any creative variations of their own. However, each main model can be built, tested and explored by two buddies, and the parts put away again within a single lesson.

How do I handle the Building Instructions booklets?

For easy classroom management we suggest storing the Building Instruction booklets in separate plastic folders in binders so that they are at hand and ready to use at the beginning of each lesson.

What's needed in my classroom?

Tables may be pushed aside to let models roll across a smooth floor. A desk fan may be needed to make a breeze, hair-dryers to make land yacht races, etc. Ideally, a computer or computers should be available for children to explore the Jack and Jill animated activity briefings.

Children need to be able to construct in pairs facing each other or side-by-side. From teachers and classrooms we have learnt that canteen-type trays are ideal to build on, and to stop elements rolling onto the floor. It is also an advantage to have a cupboard or shelves to store the sets lying flat with any unfinished models on top of them.

Any other materials needed will be very common in all classrooms and are listed at the start of each activity.

Enjoy!
LEGO® Education