



education

Learning with LEGO® Education: How robotics can meet the NSW Science and Technology K-6 Syllabus outcomes

This document was developed by Kylie Stanley
Teacher, NSW Department of Education

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Skills	Working Scientifically	STe-1WS-S observes, questions and collects data to communicate ideas.	Share observations and ideas based on guided investigations.	Students share observations and ideas through the WeDo 2.0 Software/App - Capture or Documentation tool.	Students use the WeDo 2.0 Software/Apps built-in camera, video and/or screenshot tool during investigations and projects. Students record their observations and ideas, question and collect data and export as a PDF or as an image file.
	Design and Production	STe-2DP-DT develops solutions to an identified need.	Evaluate success of design ideas, processes or solutions according to personal preferences and/or predetermined criteria.	Students use WeDo 2.0 kit to design playground equipment based on a design brief, for example, a seesaw.	Students explore simple parks and playgrounds in their local area. Students design, build and program a seesaw and test their prototypes. Students share their designs and evaluate based on design brief.

Robotics Links to Science and Technology K-6 Syllabus

Early Stage 1

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes	
Knowledge and understanding	Living World	STe-3LW-ST explores the characteristics, needs and uses of living things.	Recognise that living things have basic needs including air, food and water.	Students use WeDo 2.0 kit to build a living thing (see Curriculum Pack Open or Guided Projects such as Frogs Metamorphosis, Plants and Pollinators, Animal Expression or see Model Library).	Students research a type of animal or plant (WeDo 2.0 Software/App examples include frog, bee and flower, praying mantis, snake, dolphin, gorilla, fish, spider, caterpillar or firefly) and identify its basic needs. Students then design, build and program a model of their chosen living thing or plant. Students share their research and compare basic needs of living things or plants with other groups.	
			Compare the basic needs of some plants and animals.			
	Material World	STe-4MW-ST identifies that objects are made of materials that have observable properties.	Identify and describe how the properties of different materials suit their design purpose.			Students investigate the observable features of WeDo 2.0 kit construction pieces and compare them to other materials through a design task. Students plan, design and evaluate a product.
			Plan, design and evaluate a product considering an identified need or opportunity.			

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and Understanding	Physical World	<p>STe-5PW-ST observes the way objects move and relates changes in motion to push and pull forces.</p>	<p>Observe the way a variety of familiar objects move, for example;</p> <ul style="list-style-type: none"> • sliding • rolling • spinning • bouncing <p>Observe the effects of push and pull forces on similar objects, for example, changes in motion.</p>	<p>Students use WeDo 2.0 kit to build and program a Pull-robot or vehicle (see Curriculum Pack - Open and Guided Projects such as Pulling or Speed).</p>	<p>Students build and program a Pull-robot and observe the effects of adding both light and heavy objects. Discuss cause and effect.</p> <p>Students build and program a vehicle and test different factors such as the effects of adding/removing small wheels and big wheels, and observe the time it takes to travel certain distances. Compare predicted outcomes to results.</p> <p>Alternatively, use ramp to investigate how cars travel with and without a push or pull.</p>
		<p>Participate in investigations to explore how particular objects move on land, water and/or in the air, and how these objects are affected by forces.</p>			
	Earth and Space	<p>STe-6ES-S identifies how daily and seasonal changes in the environment affect humans and other living things.</p>	<p>Identify daily and seasonal changes that occur in our environment, such as changes in weather, for example, monthly rain, snow or frost.</p>	<p>Students use WeDo 2.0 kit (see Curriculum Pack - Open Project Hazard Alarm to design a prototype of a weather alarm device to alert people and reduce the impact of severe storms).</p>	<p>Students explore natural hazards in history (e.g. flood and fire) and discuss ways to alert people and reduce the impact of hazards. Students design, build, program and test an alarm device for wind, rain, fire, earthquake or other natural/weather-related hazards.</p>

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and Understanding	Digital Technologies	<p>STe-7DI-T identifies digital systems and explores how instructions are used to control digital devices.</p>	Follow and describe a sequence of steps (algorithms).	<p>Students use WeDo 2.0 kit to build a form of transport/mechanism (See Curriculum Pack Open and Guided Projects such as Pulling or Speed as a base).</p>	<p>Students build and program a form of transport/mechanism that can move an object from one location to another. Students document the sequence of steps (algorithm) involved using the WeDo Software/App Capture or Documentation tool.</p>
			Design a process to solve an identified problem, for example, a set of instructions to get from one point to another.		

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Skills	Working Scientifically	ST-1WS-S observes, questions and collects data to communicate and compare ideas.	Record observations accurately and honestly using observational drawings, labelling, informal measurements and digital technologies.	Students collaborate (in pairs) to develop design solutions. They share observations and ideas through the WeDo 2.0 Software/App - Capture or Documentation tools.	Students document the sequence of steps (algorithm) involved in solving complex problems using the WeDo 2.0 Software/App Capture or Documentation tool. Students record their observations and ideas, question and collect data and export as a PDF or as an image file.
	Design and Production	ST1-2DP-T uses materials, tools and equipment to develop solutions for a need or opportunity.	Collaborate to develop designed solutions.		
		ST1-3DP-T describes, follows and represents algorithms to solve problems.	Segment and sequence steps for making designed solutions.		

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Living World	ST1-4LW-S describes observable features of living things and their environments.	Explore how living things grow, change and have offspring similar to themselves.	Students use WeDo 2.0 kit to explore the relationship between a pollinator and a flower during the reproduction phase or alternatively model a frog's metamorphosis and identify the characteristics of the organism at each stage (see Curriculum Pack, Guided Projects Frogs Metamorphosis, Plants and Pollinators).	Students build a model of a bee and a flower, simulating the relationship between pollinator and flower during the reproduction phase. Students document how things grow and change.
		ST1-5LW-T identifies how plants and animals are used for food and fibre products.	Identify some plants and animals that are grown and used for food production.		Students build models of a frog during each phase of its metamorphosis. Discuss how the frog grows and changes at each phase. Additionally, discuss how honey is used for food production and how it makes its way to us for consumption.

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Material World	<p>ST1-6MW-S identifies that materials can be changed or combined.</p>	Investigate how materials can be combined.	Students use WeDo 2.0 kit to design a device that uses physical properties of objects, including their shape and size, to sort them (see Curriculum Pack Guided Project - Sort to Recycle).	Students design, build and program a recycling sorting truck and explore various types of materials and how they can be used to build a product/mechanism (elastic bands, rope, plastic, rubber tyres). Students discuss the characteristics of objects that can be observed or measured without changing their chemical composition, such as appearance, smell or height. Discuss how items that are recycled can be converted into usable materials.
		<p>ST1-7MW-T describes how the properties of materials determine their use.</p>	Design and evaluate a product, demonstrating understanding of the suitability of materials for a purpose.		

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Physical World	<p>ST1-8PW-S describes common forms of energy and explores some characteristics of sound energy.</p>	<p>Explore sound, light, heat, electricity and movement as forms of energy.</p>	<p>Students use WeDo 2.0 kit to explore inputs (sensors) and outputs (sound, light and movement) as forms of energy. Students make a sound machine (see WeDo 2.0 Maker Activities - Primary School).</p>	<p>Students design and build a simple sound machine. By combining the WeDo 2.0 Smarthub and a sensor, the sound library makes a simple sound machine with many possibilities, including the ability to record and play a custom sound or melody.</p>
		<p>ST1-9PW-ST investigates how forces and energy are used in products.</p>	<p>Explore how technologies use forces to create movement in products.</p>	<p>Students use WeDo 2.0 kit to build a robot car (see Curriculum Pack Model Library, Drive or Lift).</p>	<p>Students follow build instructions for WeDO 2.0 vehicle. Students test cars of different sizes, weight, and length and observe. Students compare predicted outcomes to results. Students describe how changes to the car affect movement.</p>

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Earth and Space	ST1-10ES-S recognises observable changes occurring in the sky and on the land and identifies Earth's resources.	Plan and implement strategies considering conservation of resources to address sustainability and to meet personal and/or community needs, for example, turning off unnecessary lights.	Students use WeDo 2.0 kit to build an energy efficient solution to conserve light resources, for example, students could build a car and add a garage (see Model Library on WeDo 2.0 App - Drive or Lift).	Students explore and discuss characteristics of energy efficient cities. Students design and build an energy efficient house, for example, lights turn on when car approaches the garage (using motion sensor and Smarthub light). Students make other recommendations for conserving resources.
	Digital Technologies	ST1-11DI-T Identifies the components of digital systems and explores how data is represented.	Follow and represent sequences of steps and decisions (algorithms) to solve problems, for example, presenting a sequence of instructions, using a visual programming language.	Students use WeDo 2.0 kit to build a form of transport/mechanism (See Curriculum Pack, Moving Materials or Sort and Recycle for Recycling or Garbage Truck).	Students design, build and program a form of transport/mechanism that can move an object (for example, marbles) from one location to another in a safe and efficient way. Students document the sequence of steps (algorithm) involved using the WeDo Software Capture or Documentation tool.

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Skills	Working Scientifically	ST2-1WS-S questions, plans and conducts scientific investigations, collects and summarises data and communicates using scientific representations.	Collect and record accurate, honest observations using labelled observational drawings, basic formal measurements and digital technologies as appropriate.	Students share observations and ideas through the WeDo 2.0 Software/App - Capture or Documentation tool.	<p>Students use built-in camera, video and/or screenshot tool during investigations and projects.</p> <p>Students record their observations design ideas, question and collect data and export as a PDF or as an image file.</p> <p>Students document the sequence of steps (algorithm) involved in solving complex problems using the WeDo 2.0 Software/App Capture or Documentation tool.</p>
	Design and Production	ST2-SDP-T selects and uses materials, tools and equipment to develop solutions for a need or opportunity.	Consider potential resources in defining design needs and opportunities.		
		ST2-3DP-T defines problems, and designs, modifies and follows algorithms to develop solutions.	Develop a sequence of steps and decisions (algorithms) to solve a problem.		

Strand	Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Living World ST2-4LW-S compares features and characteristics of living and non-living things.	Collect data and identify patterns to group living things according to their external features, and distinguish them from non-living things.	Students use WeDo 2.0 kit to design and build a simulation of a living thing that is able to communicate with its environment through light, movement or sound (See Curriculum Pack, for example, Guided Projects such as Frog's Metamorphosis, Plants and Pollinators or Model Library - Wobble, Walk, Flex, Reel, Grab, Push or Tilt).	Students research a type of living thing (WeDo 2.0 examples include frog, bee and flower, praying mantis, snake, dolphin, gorilla, fish, spider, caterpillar or firefly) and identify how they grow, change and have offspring. Students design, build and program a model of their chosen living thing using WeDo 2.0. Students share their findings needs of living things with other group's information using WeDo Software/App Capture or Documentation tool.
	ST2-5LW-T describes how agricultural processes are used to grow plants and raise animals for food, clothing and shelter.	Investigate and compare advancing technologies used in food and fibre production in Australian agriculture and those used in traditional agriculture, for example, autonomous vehicles to harvest crops compared to manual harvesting processes.	Students use WeDo 2.0 to build and program an automated harvester (see Curriculum Pack Model Library such as Steer or Sweep).	Students explore how advancing technologies are used in food production, such as a harvester used in agriculture to harvest fibres such as cotton or wheat and discuss the harvesting process. Students design and program an automated harvester to clear crops and simulate.

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Material World	ST2-6MW-S describes how adding or removing heat causes a change of state.	Recognise that change in state can be caused by adding or removing heat.	Investigate how the properties of natural and processed materials influence their suitability and use in products, services and/or environments, for example, thermal conductivity.	Students discuss energy changes in a moving robot (consider how energy is stored, electric pulse, gearing, wheel and friction). Students make predictions and investigate how a robot moves on different surfaces, i.e. carpet, floor tiles, hard surfaces). Students discuss what changes can be made to the investigation to maintain and 'fair' test. Students evaluate the suitability of materials for best performance.
		ST2-7MW-T investigates the suitability of natural and processed materials for a range of purposes.	Investigate how the properties of natural and processed materials influence their suitability and use in products, services and/or environments, for example, thermal conductivity.		

Strand	Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	<p>ST2-8PW-ST describes the characteristics and effects of common forms of energy, such as light and heat.</p>	<p>Explore some common sources and uses of electrical energy and describe different ways electrical energy can be generated sustainably, for example, wind turbines.</p>	<p>Students use WeDo 2.0 kit to design, build and program a model of a wind turbine.</p>	<p>Students discuss and investigate energy production from wind turbine and solar panels, and collect data the amount of energy produced. Students build and program a model of a wind turbine. Additionally, students investigate cost and efficiency of solar panels.</p>
	<p>ST2-9PW-ST Describes how contact and non-contact forces affect an object's motion.</p>	<p>Observe how contact and non-contact forces cause changes in the motion of objects, for example, changes in speed and/or direction.</p>	<p>Students use WeDo 2.0 kit to build a vehicle (see Curriculum Pack, Guided Project - Speed).</p>	<p>Students build a vehicle. Students test cars of different sizes, weight, and length and compare predicted outcomes to results. Students describe how changes to the car affect movement i.e. speed and/or direction.</p>

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Earth and Space	<p>ST2-10ES-S Investigates regular changes caused by interactions between the Earth and the Sun, and changes to the Earth's surface.</p>	Investigate how the Earth's rotation on its axis causes regular changes including night and day.	Students use WeDo 2.0 kit to build a simple model of the Sun and Earth (orrery) to simulate Earth's rotation on its axis and changes in night and day.	Students investigate and discuss how the Earth's rotation on its axis causes regular changes including night and day. Students design, build and program a model to simulate the relative rotation and orbital periods of Earth. Students document in the WeDo Software/App Screen Capture or Documentation tool.
	Digital Technologies	<p>ST2-11DI-T Describes how digital systems represent and transmit data.</p>	Describe and follow a sequence of steps or decisions (algorithms) to solve defined problems involving branching and user input, for example, create and follow algorithms using branching.	Students use WeDo 2.0 kit or Mindstorms EV3 Core Set (45544) to follow a sequence of steps and to explore new programs and use visual programming to modify existing programs, involving branching and user input.	Design a sequence of steps (algorithm) for another students robot to follow to solve a problem, for example, getting from one point to another (with obstacles). Students document the sequence of steps (algorithm) involved using the WeDo Software Capture or Documentation tool.

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Skills	Working Scientifically	ST3-1WS-S Plans and conducts scientific investigations to answer testable questions, and collects and summarises data to communicate conclusions.	Select appropriate measurement methods, including formal measurements and digital technologies, to record data accurately and honestly.	Students use Mindstorms EV3 Core Set (45544) to follow a sequence of steps and to explore new programs and use visual programming to modify existing programs, involving branching, iteration and user input.	Design a sequence of steps (algorithm) for another students robot to follow to solve a problem, for example, getting from one point to another (with obstacle avoidance). Students document the sequence of steps (algorithm) involved using the Mindstorms EV3 Software Content Editor.
	Design and Production	ST3-2DP-T Plans and uses materials, tools and equipment to develop solutions for a need or opportunity.	Design, modify and follow simple algorithms.		
		ST3-3DP-T Defines problems, and designs, modifies and follows algorithms to develop solutions.	Implement digital solutions as visual programs involving branching, iteration and user input.		

Strand	Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes	
Knowledge and understanding	Living World	<p>ST3-4LW-S Examines how the environment affects the growth, survival and adaptation of living things.</p>	<p>Describe the structural and/or behavioural features of some native Australian animals and plants and why they are considered to be adaptations.</p>	<p>Students use WeDo 2.0 kit to create representation of the behaviour of predators and their prey (see WeDo 2.0 Curriculum Pack Open Project - Predator and Prey).</p>	<p>Students build and program a predator and prey model in order to describe the relationship between a predator and its prey and how it affects their survival.</p>
		<p>ST3-5LW-T Explains how food and fibre are produced sustainably in managed environments for health and nutrition.</p>	<p>Identify and sequence the process of converting 'on-farm' food and fibre products into a product suitable for retail sale.</p>	<p>Students use Mindstorms EV3 Core Set (45544) to build and program an automated mill. Alternatively, Students use WeDo 2.0 kit (see Curriculum Pack Model Library such as Spin or Revolve).</p>	<p>Students explore how advancing technologies are used in food production, such as a mill used in agriculture convert wheat into suitable products for retail sale. Students design and program an automated mill to grind grain into flour. Students report on process from farm to supermarket shelf.</p>

Strand		Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	Material World	ST3-6MW-S Explains the effect of heat on the properties and behaviour of materials.	Investigate characteristics and properties of a range of materials and evaluate the impact of their use.	Students use Mindstorms EV3 Core Set (45544) to design and build an energy efficient house. Lights turn on when car approaches the garage.	Students design, build and program an energy efficient house. Lights turn on when car approaches the garage. Students write a report on the energy efficient house and suggest possible improvements.
		ST3-7MW-T Explains how the properties of materials determines their use for a range of purposes.	Design a sustainable product, system or environment individually and/or collaboratively considering the properties of materials.		
Knowledge and understanding	Physical World	ST3-8PW-ST explains how energy is transformed from one form to another.	Perform a scientific investigation to explore the effects of changing the strength of the force of air resistance by changing the shape of an object results in increases or decreases in speed.	Students use either the WeDo 2.0 kit (see Curriculum Pack 'Getting started' for Cooling Fan) or Mindstorms EV3 Core Set (45544).	Students design, build and program a cooling fan and test the effects of larger and smaller fan blades and the speed of the motor on changing the strength of the air.
		ST3-9PW-ST investigates the effects of increasing or decreasing the strength of a specific contact or non-contact force.	Design, test and evaluate a product or system that involves an energy transformation to meet an identified need using electrical energy.		

Strand	Objectives and outcomes	Content/Skills Focus	LEGO Education	Teacher Notes
Knowledge and understanding	<p>ST3-10ES-S Explains regular events in the solar system and geological events on the Earth's surface.</p>	<p>Compare the key features of the planets of our solar system, for example;</p> <ul style="list-style-type: none"> • time it takes for the planets to revolve around the Sun • size of planets • distance of the planets from the Sun. 	<p>Students use either the WeDo 2.0 or Mindstorms EV3 Core Set (45544) to build a 'Mars Rover' to explore distant planets.</p> <p>WeDo 2.0 kit (see Curriculum Pack Getting started Project - Milo the Science Rover or Open Project - Space Exploration).</p> <p>Mindstorms EV3 (see EV3 Driving Base build instructions and use Robot Educator for examples, such as 'Move object' or 'Stop at Object').</p>	<p>Students research a planet in our solar system and identify its key features including its terrain for exploration by a 'Mars Rover', time it takes to revolve around the Sun, size, and distance from the Sun. Students design, build and program a 'Mars Rover' to move simulate one of the following:</p> <ul style="list-style-type: none"> • Move in and out of a crater • Collect a rock sample • Drill a hole in the ground <p>Students share their prototypes with the class using Content Editor.</p>
	<p>ST3-11DI-T Explains how digital systems represent data, connects together to form networks and transmit data.</p>	<p>Design, modify and follow algorithms involving branching and iteration.</p>	<p>Students use Mindstorms EV3 Core Set (45544) to follow a sequence of steps and to explore new programs and use visual programming to modify existing programs, involving branching and iteration.</p>	<p>Design a sequence of steps (algorithm) for another students robot to follow to solve a problem, for example, getting from one point to another (with obstacle avoidance).</p> <p>Students document the sequence of steps (algorithm) involved using the Content Editor.</p>

