Welcome to LEGOLAND California!

Education Programs: Adventure-Bots was developed by the LEGO® Education DK and LEGOLAND California Education Department. For information on LEGOLAND Education programs, visit www.legoland.com/edu

Arrival and Entry: Please arrive 30 minutes before your program. Teachers must be present during the 45-minute program.

Extended Learning in the Park: Lab Notes are provided to guide your experience through recommended rides and attractions, to enhance the Adventure-Bots-themed educational experience and provide applied learning.

Lunches: School groups may bring lunches in disposable containers or may be pre-ordered when you book your program.

Safety: LEGOLAND Parks are built to the highest standards of quality and safety. Height restrictions apply on selected attractions throughout the park.

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Background Information: Real world robots!

Robots are at work and play all over the world. Some are autonomous, and some require human remote control. Robots extend our grasp, improve our abilities, and travel to places too dangerous for us to go. Check out these real-life 21st century robots!

See more at http://www.theatlantic.com/infocus/2012/10/robots-at-work-and-play/1--389

The robotic Legged Squad Support System (LS3) was developed to help U.S. military to carry heavy loads and equipment over rough terrain. (USCM/Sgt. Mallory S. VanerSchans)

The Wall-Ye robot prunes vines at a vineyard in France. Its four wheels, two metal arms, six web cameras and a GPS helps it roll between grapevines, test soil and check the grapes. The inventor worked on Wall-Ye for three years. (Reuters/Robert Pratta)

“Rex” helps Sophie Morgan walk! “Rex” is a Robotic Exoskeleton in London, England. Rex enables wheelchair users to stand upright and walk independently. Sophie was paralyzed from the breast bone down in 2003 following a car accident. (Dan Kitwood/Getty Images)

Wu, an electric bike mechanic, welds a component to fit onto his newly-made robot at his repair shop in China. Wu spent over 10 days to make this robot using parts from abandoned electric bikes. The robot walks and pumps up tires by itself. (Reuters/Stringer)
Hands-on Activity

Adventure Bots in the LEGO® MINDSTORMS® Lab
Complete adventurous missions like search, recover and conceal treasures in the ancient temple. Don’t forget to disarm the guard!

- Students work in pairs with a robot, attachments, and Adventure-Bots treasure-seeking software.
- Each pair plans a strategy to complete the robotic tasks needed to find the hidden treasures.
- Use the icon-based program to set up the robot’s actions, and then test it on the ancient temple table.
- Students modify their program based on results, until one or more missions is completed successfully.
- They have a chance to demonstrate their strategy to the group.

Check out the Robot Body
Find the NXT brick, a tiny computer that is the robot's “brain.”
Find the Infrared window, which receives instructions for action.
Find the light sensor, programmed to read light intensity from the environment.
Choose a motorized attachment which can help you with a specific challenge.

Create a program on the screen
Click and drag the commands in the order that you want your Adventure-Bot to act.
Go forward, backward, left, right, follow a line, and finish off with a victory dance!

Take your Adventure-Bot to the Table
- Press the orange “Start” button and watch your Adventure-Bot travel!
- Adjust the commands to go farther, faster, slower, turn, or shoot, so that Adventure-Bot completes the mission!
- Try to complete all four Adventures!
Discovery and Learning:
Applied Robotics: Lost Kingdom Adventure

Robots in Lost Kingdom Adventure
The Lost Kingdom Adventure ride uses robotic animations, also known as animatronics.

Some models are animated and are larger scale representations of a LEGO® mini-figure.

Models are pneumatically driven, meaning they move using the power of air, along with electronic control.

Sensors in Lost Kingdom Adventure
Two types of sensors are used in Lost Kingdom Adventure.

The first is a light sensor on the targets. Each target has a numeric value attached to it. When you “hit” the target with your laser, the sensor adds the point value to your score. Some of these sensors also trigger movement of other robots.

The other type of sensor identifies the presence of the ride vehicle. It triggers, or starts, a “show” element to the ride. When the sensor is triggered, a robotic figure moves or speaks.

Describe one or more targets that you successfully hit with a light sensor.
Describe one place where a sensor triggered some action.
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In Pittsburgh, this man operates his prosthetic arm with his brain! He had a chip implanted on the surface of his brain that reads his intention to move his paralyzed arm. The chip sends that instruction to an advanced bionic arm. (AP Photo/University of Pittsburgh Medical Center)

An unmanned aerial vehicle (UAV), or drone, flies over France. Firefighters were testing the robot as an innovative forest surveillance system to monitor fire outbreaks. (Pierre Andriew/AFP/Getty Images)

Fashion fans can virtually try on their clothes! Shape-shifting robotic mannequin in Estonia grow from slim to muscular. About 2000 different body shapes are being used. This saves the Fits.me online company because people do not return clothes as frequently. (Priit Simson/AFP/Getty Images)

"Treebot", in China, has two grippers that dig into bark so it can wriggle up a tree like a caterpillar. It weighs less than 2.2 lbs, can carry a camera and is designed to climb trees in place of humans, to perform health checks. (Reuters/Tyrone Siu)
About Adventure-Bots

Learning Outcomes

- Interpret diagrams to build robot attachments.
- Develop a strategy to complete tasks with an autonomous robot.
- Program a robot to perform tasks such as retrieval, delivery, and target-hitting.
- Explain strategy and evaluate effectiveness.
- Explore background information to learn about real life robots.
- Discover robotics applications on LEGOLAND® rides and attractions.

Proposed California’s Next Generation Science Standards

GRADE 3-5 Engineering Design
3-5-ETS1-1 Define a simple design problem... that includes criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2 Generate and compare multiple possible solutions... based on how well each is likely to meet the criteria....
3-5-ETS1-3 Plan and carry out fair tests... to identify aspects of a model or prototype that can be improved.

GRADE 4  Energy
4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

GRADE 4  Waves and their Applications in Technologies for Information Transfer
4-PS4-3 Generate and compare multiple solutions that use patterns to transfer information.

GRADE 6  Engineering Design
MS-ETS1-1 Define criteria & constraints of a design problem... to ensure a successful solution, taking into account relevant scientific principles....
MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria/constraints of problem.
MS-ETS1-3 Analyze data from tests... to ID the best characteristics of each (design solution) that can be combined... to... meet criteria for success.

The performance expectations above were developed using NRC Framework for K-12 Science Education:

Science and Engineering Practices

- Asking Questions and Defining Problems
  - Define a simple problem that can be solved thru development of 1) A new/improved object... & includes... criteria for success...(3-5-ETS1-1)
  - (or) 2) An object, tool, process ...& includes multiple criteria/constraints, including scientific knowledge that may limit possible solutions.(MS-ETS1-1)

- Planning and Carrying Out Investigations
  - Make observations to produce data as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)

- Construct Explanations and Design Solutions
  - Generate & compare solutions... based on how well they meet criteria and constraints of the design solution. (3-5-ETS1-2), (4-PS4-3)

Disciplinary Core Ideas

ETS1.A Defining and Delimiting Engineering Problems
- ...Different... solutions can be compared on the basis of how well each one meets the criteria for success.... (3-5-ETS1-1)

ETS1.B Develop Possible Solutions
- ...Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)
- Communicating with peers about proposed solutions... can lead to improved designs. (3-5-ETS1-2)
- Tests are often designed to identify... difficulties, which suggest elements... that need to be improved. (3-5-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C Optimizing the Design Solution
- (Test) different solutions to determine which best solves the problem, given the criteria and constraints. (3-5-ETS1-3)
- Different solutions need to be tested to determine which best solves the problem, given the criteria and constraints. (secondary to 4-PS4-3)
- ...ID'ing characteristics of the design that performed the best... can provide useful information for redesign... (MS-ETS1-3)
- ... (Test) ing the most promising solutions and modifying... on the basis of test results leads... ultimately to an optimal solution. (MS-ETS1-4)

PS3.A Definitions of Energy: Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2)

PS3.B Conservation of Energy and Energy Transfer
- Energy can also be transferred from place to place by electric currents... to produce motion, sound, heat, or light. (4-PS3-2)

PS4.C Information Technologies and Instrumentation
- Digitized information transmitted over long distances without significant degradation.
- High-tech devices, such as computers or cell phones, can receive and decode information....(4-PS4-3)

Crosscutting Concepts

Energy and Matter
- Energy can be transferred in various ways and between objects. (4-PS3-2)

Interdependence of Science, Engineering, and Technology
- Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)

Influence of Engineering, Technology, and Science on Society and the Natural World
- People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)
- Engineers improve existing technologies or develop new ones to increase benefits, decrease risks, & meet societal demands. (3-5-ETS2-2)

ELA/Literacy –

SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3)

RI.5.7 Draw on information from multiple print or digital sources... to locate an answer... quickly or solve a problem efficiently. (3-5-ETS2)

RST.6-8.7 Integrate quantitative/technical info expressed in words in a text with a version... expressed visually... in a diagram or model.... (MS-ETS1-3)

Mathematics –

MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)

MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)